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Superfund Treatment Technologies
A Vendor Inventory

Versar, Inc., Springfield, VA

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SUPERFUND TREATMENT TECHNOLOGIES:

A VENDOR INVENTORY

by
Camp Dresser & McKee Inc.
Boston, MA 02108

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Project Officer

Linda D. Galer
Hazardous Response Support Division

Office of Solid Waste and Emergency Response
Office of Emergency and Remedial Response
Washington, D.C. 20460

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This document was designed to provide Superfund site managers, engineers and planners with the current information on the capability and availability of mobile treatment units for Superfund waste. Increased use of these systems is becoming necessary as alternatives to land disposal are emphasized. The document contains descriptions and technical information on mobile treatment units currently available or being built. This information was obtained from those companies known to have, or be in the process of developing, mobile treatment units. Mobile units under development were reviewed if pilot-scale units were operating, or if the system would be commercially available in two to four months (six to eight months for thermal units). Additional companies may be added to the document periodically as new information becomes available.

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Tony LoRe - Thermal systems.

Arthur Quaglieri - Immobilization systems.

These people may be contacted for additional information at the following address:

Camp, Dresser and McKee, Inc.
One Center Plaza
Boston, MA 02108
(617) 742-5151

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SECTION 1
INTRODUCTION

This document was designed to provide Superfund site managers, engineers and planners with the current information on the capability and availability of mobile treatment units for Superfund waste. Increased use of these systems is becoming necessary as alternatives to land disposal are emphasized.

To evaluate the use of mobile treatment technologies, the user must be aware of the current and future availability of mobile units, and the capacities, capabilities, and cost of these units. Previously, this information could only be obtained by contacting many different companies. To expedite this process, the Environmental Protection Agency Office of Solid Waste and Emergency Response (EPA OSWER) conducted a review of many commercially available mobile treatment units, and compiled this inventory of many of the mobile units that are available, or will soon be available, for use.

This document contains descriptions and technical information on mobile treatment units currently available or being built. This information was obtained from those companies known to have, or be in the process of developing, mobile treatment units. Mobile units under development were reviewed if pilot-scale units were operating, or if the system would be commercially available in two to four months (six to eight months for thermal units). Additional companies may be added to the document periodically as new information becomes available.

The information was categorized according to the type of technology used (immobilization, thermal, physical/chemical and biological processes). Some companies provided specific technical information on process requirements unique to their technology. Companies that market several treatment units using different technologies may have provided detailed information on each unit. The information provided included:

- number of units available
- technical process utilized
- capacity
- waste types handled
- restrictive waste characteristics
- treatment efficiencies
- residuals generated
- site and waste type information requirements
- permit requirements
- cost estimates

The companies themselves provided the descriptions of available treatment units, and identified the capabilities and limitations. Some units may be in developmental stages and have not been tested on a Superfund site.

The information provided should be used only as a guideline to determine if a technology is appropriate to a given site. Individual companies should be contacted to obtain information on system capabilities and costs for specific sites and wastes. It is recommended that users get additional information on a mobile unit's capabilities and performance from previous clients or independent contractors.

To standarize cost data, companies were provided with four hazardous waste site scenarios for costing purposes. Several companies chose not to provide detailed cost information due to either time constraints, lack of sufficient data in the scenario, or the decision that cost information could only be provided directly to a client. Those companies that did provide cost information did so with the understanding that it was to be used only as a rough guideline, and that actual costs can vary significantly due to small differences in site conditions or waste characteristics.

Because of time constraints, detailed technical information was not compiled on all mobile units. A survey conducted by Tufts University Center for Environmental Management gathered general information from many of the companies listed in the following tables (Section 2). Detailed technical information on certain companies is presented in subsequent chapters according to technology. Those systems for which detailed information was available are summarized in table form at the beginning of each chapter. As noted before, the document user should contact the companies for additional information that will pertain to specific waste and site conditions.

In using this document, it is important to consider that each described mobile treatment unit is a specifically designed treatment and removal process for a certain class of substances (e.g., metals). A particular treatment unit may need to be integrated into a multi-unit treatment train to provide complete treatment of a particular waste stream. The development of a complete treatment system to deal with the different waste characteristics should precede the selection of these mobile units. Given the characteristics of the waste types found on a site, many of the companies listed will provide recommendations for treatment system design using either their own units or an integrated system using treatment units from several companies.

In evaluating the applicability, performance, and cost-effectiveness of a treatment option, the following key factors should be considered, among others:

- Performance and reliability when waste stream characteristics vary,
- Monitoring requirements,
- Costs for mobilization and operation,
- Adaptability and compatibility with other treatment train components,
- Extent of requirements for providing and upgrading the site facilities (e.g., utilities, roads),
- Management requirements for the residuals generated (i.e., post treatment, disposal).

SECTION 2
COMPANY CAPABILITIES BY WASTE TYPE

The following tables list the companies that can process waste of a particular type using a mobile system. More detailed information on some of the companies listed is included in later sections.

Each waste type is addressed in a separate table as listed below:

Table 2.1 - Waste Containing Organics
Table 2.2 - Aqueous Waste Containing Metals
Table 2.3 - Waste Containing PCBs
Table 2.4 - Waste Containing Dioxins
Table 2.5 - Waste Containing Pesticides
Table 2.6 - Waste Containing Explosives
Table 2.7 - Waste Containing Asbestos
Table 2.8 - Waste Containing Cyanides
Table 2.9 - Waste Containing Corrosives or Reactives

Companies are listed under multiple waste type categories if they offer several different waste treatment systems, or their systems are capable of treating more than one of the type of wastes listed above.

TABLE 2.1

WASTES CONTAINING ORGANICS

Company Name	Waste Form	Process
American Toxic Disposal Inc. 560 Seahorse Drive Waukegan, IL 60085 Tel: (312) 336-6067 Contact: William Meenarm	Organics in sludge and soil	High temperature extraction followed by incineration or treatment of extracted organics.
ATW-Calweld[1] 11300 South Norwalk Blvd. Santa Fe Springs, CA 90670 Tel: (213) 929-8103 Contact: John Royle	Organics in soils, sludges	Augering system with simultaneous contaminant monitoring. In situ fixation, biodegradation, or chemical treatment injection system.
Bird Environmental Systems[1] 100 Neponset Street South Walpole, MA 02071 Tel: (617) 668-0400 Contact: Neil D. Policow	Multi-phase liquids and sludges containing organics	Physical phase separation and dewatering of wastes
Bondico Incorporated[1] 2410 Silver Street Jacksonville, FL 32206 Tel: (904) 358-2602 Contact: Mark Shaw	Organics liquids, sludges, and solids	Encapsulate, salvage drums
Calgon Carbon Corp.[1,2] Box 717 Pittsburgh, PA 15230-0717 Tel: (412) 787-6700 Contact: Joseph Rizzo	Most organics in groundwater and wastewater	Activated carbon adsorption in conjunction with air stripping and pH adjustment, as needed
Carbon Air Services[1] P.O. Box 5117 Hopkins, MN 55343 Tel: (613) 935-1844 Contact: Bruce P. Anderson	Most organics in groundwater and wastewater	Carbon adsorption, air stripping, metals precipitation, oil/water separation, membrane separation, and multimedia filtration
Chemical Waste Management[2] 150 West 137th Street Riverdale, IL 60627 Tel: (312) 841-8360 Contact: Peter Daley	Oil contaminated with PCBs and similar chlorinated organics; other halogenated hydrocarbons	Stabilization, oxidation, carbon adsorption, PCB dechlorination

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[1] Tufts University Center for Environmental Management Survey

[2] EPA OSWER Mobile Unit Inventory

TABLE 2.1

WASTES CONTAINING ORGANICS

Company Name	Waste Form	Process
Chemfix Tech[2] 1675 Airline Hwy. P.O. Box 1562 Kenner, LA 70093 Tel: (504) 467-2800 Contact: Robert A. Phelan	Any aqueous waste with solid content 5 to 60%	Solidification/fixation
Critical Fluid Systems[1] 25 Acorn Park Cambridge, MA 02140 Tel: (617) 492-1631 Contact: Peter Dunlap	Liquids and sludges with organic content from 1 to 30%	High pressure extraction of organic contaminants from medium
DETOX Inc.[1] 64 Marco Lane Dayton, OH 45459 Tel: (513) 433-7394 Contact: Evan Nyer	Organics and inorganics in groundwater and wastewater	Biological, air stripping, carbon adsorption, custom treatment systems
DETOXCO[1,2] 2700 Ygnacio Valley Road Walnut Creek, CA Tel: (415) 930-7997 Contact: Robert McMahon	Organics in solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
Dorr Oliver, Inc.[2] 77 Havemeyer Lane Stamford, CT 06904 Tel: (203) 358-3200 Contact: Dr. Paul Sutton	Biodegradable organics in wastewater and groundwater	Aerobic biodegradation and anaerobic digestion
ENSCO Environmental Services[1,2] 3rd Fl., 1st Tennessee Bank Bldg. Franklin, TN 37064 Tel: (617) 794-1351 Contact: Rob McCormack	Organics in solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
Ensotech, Inc.[1] 11550 Vanowen St. North Hollywood, CA 91605 Tel: (818) 982-4895 Contact: Doug Smith	Organics in aqueous wastes, sludges, soil	Chemical oxidation/reduction, neutralization, fixation/solidification

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[1] Tufts University Center for Environmental Management Survey
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.1

WASTES CONTAINING ORGANICS

Company Name	Waste Form	Process
Envirite Field Services[1,2] 600 Germantown Pike Plymouth Meeting, PA 19462 Tel: (215) 828-8655 Contact: Bill Howard	Organics (40-50% maximum) in pumpable sludges. Contaminated soils	Chemical fixation and solidification
Envirochem Waste Mgmt. Serv.[1,2] 975 Walnut Street Cary, NC 27511 Tel: (919) 468-8490 Contact: Jerry Deakle	Water contaminated with hydrocarbons	Physical phase separation, carbon filtration
FMC-Aquifer Remediation System[1,2] P.O. Box 8 Princeton, NJ 08543 Tel: (609) 452-8412 Contact: Joan Ridler	Groundwater and soils contaminated at low levels with readily biodegradable organics	In situ aerobic process enhanced by addition of nutrients and oxygen
GA Technologies[1,2] P.O. Box 85608 San Diego, CA 92138 Tel: (619) 455-3000 Contact: Harold Diot	Solids, liquids, sludges and soils contaminated with organics	Thermal treatment by circulating fluidized bed incineration
Hazcon, Inc.[1,2] P. O. Box 947 Katy, TX 77492 Tel: (713) 391-1085 Contact: Roy Funderburk	Volatile, halogenated, and non-halogenated organics	Seal blending unit, fixation/ solidification
Int'l Waste Energy Systems[1] 2150 Kienlen Street St. Louis, MO 63121 Tel: (314) 389-7275 Contact: D.C. Brown	Solids, liquids, sludges, soils and aqueous wastes contaminated with organics	Thermal treatment by rotary kiln incineration
IT Corp.[1] 4575 Pacheco Blvd. Martinez, CA 94553 Tel: (415) 228-5100 Contact: Ed Sirota	Organic liquids, solids and sludges	Centrifuges, belt presses, carbon adsorption systems, inorganic treatment systems, bioreactors, air strippers

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[2] EPA OSWER Mobile Unit Inventory

TABLE 2.1

WASTES CONTAINING ORGANICS

Company Name	Waste Form	Process
J.M. Huber[1,2] P.O. Box 2831 Borger, TX 79008 Tel: (806) 274-6331 Contact: Jimmy W. Boyd	Solids, liquids and soils contaminated with organics	Thermal treatment by pyrolysis (advanced electric reactor)
John Zink Service, Inc.[1] 4401 South Peoria Ave. Tulsa, OK 74170 Tel: (918) 747-1371 Contact: Kenneth E. Hastings	Solids, liquids, sludges and soils contaminated with organics	Thermal treatment by rotary kiln incineration
Kipin Industries, Inc.[1,2] 513 Green Garden Rd. Aliquippa, PA 15001 Tel: (412) 495-6200 Contact: Peter Kipin	Liquids, sludges, solids and soils contaminated with organics	Liquid stripper/vaporizer, thermal extraction from solids
Lopat Enterprises[1] 1750 Bloomsbury Ave. Wanamassa, NJ 07712 Tel: (201) 922-6600 Contact: Lewis Flax	Organic contaminants in soils, residues and sludges	Fixation/solidification additives
Mobile Solvent Reclaimers, Inc.[1,2] R.R. 1 St. Joseph, MO 64507 Tel: (816) 232-3972 Contact: Mr. Larry L. Lambing	Liquids containing spent halogenated hydrocarbons from industrial processes	Distillation
Modar, Inc.[1,2] 3200 Wilcrest Street, Suite 220 Houston, TX 77042 Tel: (713) 785-5615 Contact: Fred Sieber	Organically contaminated aqueous wastes	Thermal treatment by supercritical water oxidation
National Applied Scientific Sys.[1] 501 E. King Street P.O. Box 1988 York, PA 17405 Tel:(717) 846-3685 Contact: Francis K. McGinnis	Volatile organics in solid and and liquid forms	Thermal drying/desorption followed by offgas treatment

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TABLE 2.1

WASTES CONTAINING ORGANICS

Company Name	Waste Form	Process
National Dredging and Pumping Corp.[1] P.O. Box 127 Folcroft, PA 19032 Tel. (215) 237-0700 Contact: Guy Petroski	Organics in liquids, sludges and industrial wastes	Sludge dewatering, physical/chemical stabilization, PCB filtration
Polybac Corp.[1,2] 954 Marcon Boulevard Allentown, PA 18103 Tel: (215) 264-8740 Contact: William Ronyack & Curtis McDowell	Biodegradable organics in groundwater and wastewater	Aerobic/anaerobic treatment
PPM, Inc.[1] 10 Central Ave. Kansas, KS 66118 Tel: (913) 621-4206 Contact: Fred Lafser	Very toxic chlorinated organics (e.g., PCBs) in oil	Sodium-based dechlorination
Resource Conservation Co.[1] 3630 Cornus Lane Ellicott City, MD 21043 Tel: (301) 596-6066 Contact: Lenny Weimer	Aqueous wastes, oily sludges, leachates, groundwater, and surface waters	Evaporation/crystallization, tubular reverse osmosis, air stripping, solvent extraction, sludge treatment
Resource Recovery of America, Inc.[1] 4406 South Florida Avenue Suite 23 Executive Plaza Lakeland, FL 133803 Tel: (813) 644-7700 Contact: Robert O. Kinlart	Wastewater, groundwater, and sludges	Fixation/solidification
Rexnord Industries[2] 5103 West Beloit Rd. Milwaukee, WI 53214 Tel: (414) 643-2762 Contact: Dick Ostantowski	Groundwater and wastewater contaminated with volatile organics, cyanides	Carbon adsorption, dewatering, reverse osmosis and alkaline chlorination

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[2] EPA OSWER Mobile Unit Inventory

TABLE 2.1

WASTES CONTAINING ORGANICS

Company Name	Waste Form	Process
Rollins Environmental Services[1] 1 Rollins Plaza Wilmington, DE 19899 Tel. (302) 479-2700 Contact: Bill Philibpar	Organically contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
Shirco Infrared Systems[1,2] 1195 Empire Central Dallas, TX 75247-4301 Tel: (214) 630-7511 Contact: George Hay	Organically contaminated solids, sludges, soils	Thermal treatment by infrared incineration
Sitex Corp.[1] 231 Biniston, #560 Clayton, MO 63105 Tel: (314) 862-0010	Organically contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
Terra-Vac, Inc.[1,2] 356 Fortaleza St. San Juan, PR 00901 Tel: (809) 723-9171 Contact: Jim Malot	Soils and groundwater contaminated with volatiles	Vacuum extraction and recovery
Tetra Recovery System[2] 1121 Boyce Rd., Suite 1300 Pittsburgh, PA 15214 Tel: (412) 941-2660 Contact: O.A. Clemens	Waste oil, sludges and wastewater	Dewatering, clarification and phase separation
TWI[1] 8000 Maryland Suite 4400 St. Louis, MO 63105 Tel: (314) 727-5040 Contact: A.J. McCoy	Organically contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
Veliscol Chemical Corp.[2] 2603 Corporate Ave., Suite 100 Memphis, TN 38132 Tel: (901) 345-1788 Contact: Charles Hanson	Liquids, sludges and soils with up to 45% organics	Fixation/stabilization

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TABLE 2.1

WASTES CONTAINING ORGANICS

Company Name	Waste Form	Process
Vertech Treatment Systems[1] 12000 Pecos Denver, CO 80234 Tel: (393) 452-8800 Contact: Dr. Gerald Rappe	Dilute or concentrated organic aqueous streams, sludges, oily sludge, soils	Wet air oxidation followed by biological and carbon adsorbtion as needed
Waste-Tech Services, Inc.[1,2] 445 Union Blvd., Suite 233 Lakewood, CO 80228 Tel: (303) 987-1790 Contact: Elliott Cooper	Organically contaminated solids, liquids, sludges, soils	Thermal treatment by fluidized bed incineration
Westinghouse Hittman Nuclear, Inc.[2] 9151 Runsy Rd. Columbia, MD 21045 Tel: (301) 964-5043 Contact: Robert Conner	Aqueous liquids, ash, solids, sludges	Fixation/solidification system using portland cement based process
Westinghouse Plasma Systems[2] P.O. Box 350 Madison, PA 15663 Tel: (412) 722-5600 Contact: Bill Mellili	Organically contaminated liquids	Thermal treatment by pyrolysis (plasma arc)
Winston-Technology, Inc.[1,2] 6920 N.W. 44th Court Lauderhill, FL 33319 Tel: (305) 747-1769 Contact: Patrick A. Phillips	Organically contaminated liquids, sludges and solids	Thermal treatment by rotary kiln incineration
Zimpro, Inc.[1,2] Military Road Rothchild, WI 54474 Tel: (715) 359-7211 Contact: J. Robert Nicholson	Contaminated groundwater, municipal wastewater, organically contaminated liquids	Powdered activated carbon with biological treatment for aqueous liquids; thermal treatment by wet air oxidation for high strength non-biodegradable waste streams

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TABLE 2.2

AQUEOUS WASTES CONTAINING METALS

Company Name	Waste Form	Process
ANDCO Environmental Process[2] 595 Commercial Drive Amherst, NY 14150 Tel: (716) 691-2100 Contact: Joseph Duffey	Heavy metals such as chrome, copper, nickel, lead, zinc, tin, etc.	Electrochemical precipitation of heavy metals
ATW-Calweld[1] 1130 South Norwalk Blvd. Santa Fe Springs, CA 90670 Tel: (213) 929-8103 Contact: John Royle	Heavy metals in soils and sludges	Augering system with simultaneous contaminant monitoring. In-situ fixation, biodegradation, or chemical treatment injection system
Bethlehem Steel[1] Building H, Room A110 Bethlehem, PA 18016 Tel: (215) 694-2424 Contact: Robert M. McMullan	Metals in a solids and semi-solids	Chemical fixation/solidification
Bird Environmental Systems[1] 100 Neponset Street South Walpole, MA 01071 Tel: (617) 668-0400 Contact: Nel D. Policow	Metals in solids and sludges	Physical phase separation for two or three phase wastes
Calgon Carbon Corp.[1,2] Box 717 Pittsburgh, PA 15230-0717 Tel: (412) 787-6700 Contact: Joseph Rizzo	Groundwater and wastewater contaminated with oil	Activated carbon adsorbtion in conjunction with air stripping and pH adjustment, as needed
Carbon Air Services[1] P.O. Box 5117 Hopkins, MN 55343 Tel: (613) 935-1844 Contact: Bruce P. Anderson	Contaminants in groundwater, surface and process streams	Carbon adsorbtion, air stripping, metals precipitation, oil and water separation, membrane separation and multil-media filtration
Chemical Waste Management[2] 150 West 137th Street Riverdale, IL 60627 Tel: (312) 841-8360 Contact: Peter Daley	Chelated metals in wastewater	Stabilization, oxidation, carbon adsorption, PCB dechlorination

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TABLE 2.2

AQUEOUS WASTES CONTAINING METALS

Company Name	Waste Form	Process
Detox Inc.[1] 64 Marco Lane Dayton, OH 45459 Tel: (513) 433-7394 Contact: Evan Nyer	Metals in groundwater and wastewater	Chemical treatment, custom treatment systems
Ensotech, Inc.[1] 11550 Vanowen St. North Hollywood, CA 91605 Tel: (818) 982-4895 Contact: Doug Smith	Heavy metals in sludges, aqueous wastes, soils	Oxidation/reduction, neutralization, pre-fixation treatment and heavy metal fixation/solidification
Envirite Field Services[1,2] 600 Germantown Pike Plymouth Meeting, PA 19462 Tel: (215) 828-8655 Contact: Bill Howard	Metals in pumpable sludges and contaminated soils	Chemical fixation and solidification
Envirochem Waste Mgmt. Serv.[1,2] 975 Walnut Street Cary, NC 27511 Tel: (919) 468-8490 Contact: Jerry Deakle	Acidic aqueous wastes with heavy metals	Physical phase separation, acid and base neutralization, separation, carbon filtration
Holtz Bio Engineering[1] 18675-O Adams Court Morgan Hill, CA 95037 Tel: (408) 779-2939 Contact: Barry Holtz	Heavy metals in sludges and liquids	Reverse osmosis/deionization
IT Corp.[1] 4575 Pacheco Blvd. Martinez, CA 94553 Tel: (415) 228-5100 Contact: Ed Sirota	Metals in liquids, solids and sludges	Centrifuges, belt presses, carbon adsorption systems, inorganic treatment systems, bioreactors, air strippers
Lopat Enterprises[1] 1750 Bloomsbury Ave. Wanamassa, NJ 07712 Tel: (201) 922-6600 Contact: Lewis Flax	Contaminants in soils, residues and sludges	Fixation/solidification additive

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TABLE 2.2

AQUEOUS WASTES CONTAINING METALS

Company Name	Waste Form	Process
National Applied Scientific Sys.[1] 501 E. King Street P.O. Box 1988 York, PA 17405 Tel: (717) 846-3685 Contact: Francis McGinnis	Certain metals in solids and liquids forms	Thermal drying/desorption followed by offgas treatment
Resource Conservation Co.[1] Cornus Lane Ellicott City, MD 21043 Tel: (301) 596-6066 Contact: Lenny Weimer	Aqueous wastes, oily sludges, leachates, groundwater and waters containing waste metals	Evaporation/crystallization, tubular reverse osmosis, air and steam stripping, solvent extraction, and sludge treatment
Resource Recovery of America, Inc.[1] 4406 South Florida Avenue Executive Plaza, Suite 23 Lakeland, FL 133803 Tel: (813) 644-7700 Contact: Robert O. Kinlart	Wastewater, groundwater and sludges	Fixation/solidification
Rexnord Industries[2] 5103 West Beloit Rd. Milwaukee, WI 53214 Tel: (414) 643-2762 Contact: Dick Ostantowski	Groundwater contaminated with heavy metals	Carbon adsorption, dewatering, reverse osmosis and alkaline chlorination
Solidtek Systems, Inc.[1,2] 5371 Cook Rd. Morrow, GA 30260 Tel: (404) 361-6181 Contact: Ed Shuster	Liquids, sludges, solids, soils contaminated with heavy metals	Chemical fixation/solidification/ stabilization
Tetra Recovery System[2] 1121 Boyce Rd., Suite 1300 Pittsburgh, PA 15214 Tel: (412) 941-2660 Contact: O.A. Clemens	Waste oil, sludges and wastewater	Centrifuge and belt filter press

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TABLE 2.2

AQUEOUS WASTES CONTAINING METALS

Company Name	Waste Form	Process
Westinghouse Hittman Nuclear, Inc.[2] 9151 Runsy Rd. Columbia, MD 21045 Tel: (301) 964-5043 Contact: Robert Conner	Aqueous liquids, ash, solids, sludges containing heavy metals	Solidification system using cement based process
Zimpro, Inc.[1,2] Military Road Rothchild, WI 54474 Tel: (715) 359-7211 Contact: J. Robert Nicholson	Contaminated groundwater and wastewater with low levels of metals	Activated carbon with biological treatment in a single step

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TABLE 2.3

WASTES CONTAINING PCBs

Company Name	Waste Form	Process
American Mobil Oil Purification[1] 233 Broadway, 17th Floor New York, NY 10279 Tel: (212) 267-7073 Contact: Peter Lawson-Johnston	PCBs in oil, transformers	Remove toxic hydrocarbon compounds from host material and concentrate for incineration or chemical degradation.
American Toxic Disposal[1] 560 Sea Horse Dr. Waukegan, IL 60085 Tel: (312) 336-6068 Contact: William Meenan	PCBs in sludges, soil and sand	High temperature extraction followed by incineration of extracted organics
Bondico Incorporated 2410 Silver St. Jacksonville, FL 32206 Tel: (904) 358-2602 Contact: Mark Shaw	PCBs in liquids, sludges, solids	Encapsulation, salvage drums
DETOXCO[1,2] 2700 Ygnacio Valley Rd. Walnut Creek, CA Tel: (415) 930-7997 Contact: Robert McMahon	PCB-contaminated solids, liquid, sludges, soils	Thermal treatment by rotary kiln incineration
ENSCO Environmental Services[1,2] 3rd Fl., 1st Tennessee Bank Bldg. Franklin, TN 37064 Tel: (617) 794-1351 Contact: Rob McCormack	PCB-contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
International Waste Energy Systems[1] 2150 Kienlen Street St. Louis, MO 63121 Tel: (314) 389-7275 Contact: D.C. Brown	PCB-contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
J.M. Huber[1,2] P.O. Box 2831 Borger, TX 79008 Tel: (806) 274-6331 Contact: Jimmy W. Boyd	PCB-contaminated solids, liquids, soils	Thermal treatment by pyrolysis (advanced electric reactor)

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TABLE 2.3

WASTES CONTAINING PCBs

Company Name	Waste Form	Process
Sunohio Co. 1700 Gateway Blvd. S.E. Canton, OH 44707 Tel: (216) 452-0837 Contact: Robert Mitchell	Mineral oil and dielectric fluid contaminated with PCBs and other fluid contaminants	Dechlorination of PCBs and dioxins by PCBX process
Waste-Tech Services, Inc.[1,2] 445 Union Blvd., Suite 223 Lakewood, CO 80228 Tel: (303) 987-1790 Contact: Elliott Cooper	PCBs in liquids, sludges, and soils	Thermal treatment by fluidized bed incineration
John Zink Service, Inc.[1] 4401 South Peoria Tulsa, OK 74170 Tel: (918) 747-1371 Contact: Kenneth E. Hastings	PCB-contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
National Dredging and Pumping Corp.[1] P.O. Box 127 Folcroft, PA 19032 Tel. (215) 237-0700 Contact: Guy Petroski	PCBs in liquid sludges	Sludge dewatering, physical/ chemical stabilization, PCB filtration.
PPM, Inc.[1] 10 Central Ave. Kansas, KS 66118 Tel: (913) 621-4206	PCBs in mineral oil dielectric fluid and other oils with PCB concentrations less than 500 ppm	Dechlorination
Rollins Environmental Services[1] 1 Rollins Plaza Wilmington, DE 19899 Tel. (302) 479-2700 Contact: Bill Philibpar	PCB-contaminated solids, liquids, sludges	Thermal treatment by rotary kiln incineration
Shirco Infrared Systems[1,2] 1195 Empire Central Dallas, TX 75247-4301 Tel: (214) 630-7511 Contact: George Hay	PCB-contaminated solids, sludges, soils	Thermal treatment by infrared incineration

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[1] Tufts University Center for Environmental Management Survey
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.3

WASTES CONTAINING PCBs

Company Name	Waste Form	Process
Westinghouse Plasma Systems[2] P.O. Box 350 Madison, PA 15663 Tel: (412) 722-5600 Contact: Bill Mellili	PCB liquids	Thermal treatment by pyrolysis (plasma arc)
Winston-Technology, Inc.[1,2] 6920 N.W. 44th Court Lauderhill, FL 33319 Tel: (305) 747-1769 Contact: Patrick A. Phillips	PCB-contaminated solids, liquids, sludges	Thermal treatment by rotary kiln incineration

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[1] Tufts University Center for Environmental Management Survey
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.4

WASTES CONTAINING DIOXINS

Company Name	Waste Form	Process
American Toxic Disposal 560 Sea Horse Dr. Waukegan, IL 60085 Tel: (312) 336-6068 Contact: William Meenan	Sludges, soils and sand	Encapsulate, salvage drums, 7A type packaging
DETOXCO[1] 2700 Ygnacio Valley Rd. Walnut Creek, CA Tel: (415) 930-7997 Contact: Robert McMahon	Dioxin-contaminated solids, soils, and liquids	Thermal treatment by rotary kiln incineration
ENSCO Environmental Services[1,2] 3rd Floor, 1st Tennessee Bank Bldg. Franklin, TN 37064 Tel: (617) 794-1351 Contact: Rob McCormack	Dioxin-contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
International Waste Energy Systems[1] 2150 Kienlen Street St. Louis, MO 63121 Tel: (314) 389-7275 Contact; D.C. Brown	Dioxin-contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
J.M. Huber[1,2] P.O. Box 2831 Borger, TX 79008 Tel: (806) 274-6331 Contact: Jimmy W. Boyd	Dioxin-contaminated solids, liquids, soils	Thermal treatment by pyrolysis (advanced electric reactor)
John Zink Service, Inc.[1] 4401 South Peoria Ave. Tulsa, OK 74170 Tel: (918) 747-1371 Contact: Kenneth E. Hastings	Dioxin-contaminated liquids, solids, soils	Thermal treatment by rotary kiln incineration

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[1] Tufts University Center for Environmental Management Survey
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.4

WASTES CONTAINING DIOXINS

Company Name	Waste Form	Process
Modar, Inc.[1,2] 3200 Wilcrest Street, Suite 220 Houston, TX 77042 Tel: (713) 785-5615 Contact: Fred Sieber	Dioxin in liquid wastes and sludges	Thermal treatment by supercritical water oxidation
National Applied Scientific Sys.[1] 501 E. King Street P.O. Box 1988 York, PA 17405 Tel: (717) 846-3685	Most organics in solid and liquid forms	Thermal drying/desorption followed by offgas treatment
Shirco Infrared Systems[1,2] 1195 Empire Central Dallas, TX 75247-4301 Tel: (214) 630-7511 Contact: George Hay	Dioxin-contaminated solids, sludges, soils	Thermal treatment by infrared incineration
Sunohio Co.[1] 1700 Gateway Blvd. S.E. Canton, OH 44707 Tel: (216) 452-0837 Contact: Robert Mitchell	Dielectric fluid contaminated by dioxins and other fluids	Dechlorination of PCB and dioxins by PCBX process
Waste-Tech Services, Inc.[1,2] 445 Union Blvd., Suite 223 Lakewood, CO 80228 Tel: (303) 987-1790 Contact: Elliott Cooper	Dioxin-contaminated liquids, sludges and soils	Thermal treatment by fluidized bed incineration
Westinghouse Plasma Systems[2] P.O. Box 350 Madison, PA 15663 Tel: (412)722-5600 Contact: Bill Mellili	Dioxins in liquids and sludges	Thermal destruction by pyrolysis (plasma arc)

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[1] Tufts University Center for Environmental Management Survey
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.5

WASTES CONTAINING PESTICIDES

Company Name	Waste Form	Process
ATW-Calweld[1] 1130 South Norwalk Boulevard Santa Fe Springs, CA 90670 Tel: (213) 929-8103 Contact: John Royle	Contaminated soils, groundwater	Augering system with simultaneous contaminant monitoring. In-situ fixation, biodegradation, or chemical treatment injection system
Bondico Incorported[1,2] 410 Silver Strteet Jacksonville, FL 32206 Tel: (904) 358-2602 Contact: Mark Shaw	Liquids, sludges, solids	Encapsulation, salvage drums
Calgon Carbon Corp.[1,2] Box 717 Pittsburgh, PA 15230-0717 Tel: (412) 787-6700 Contact: Joseph Rizzo	Contaminants in groundwater and wastewater	Activated carbon adsorption in conjunction with air stripping and pH adjustment, as needed
Carbon Air Services[1] P.O. Drawer 5117 Hopkins, MN 55343 Tel: (613) 935-1844 Contact: Bruce P. Anderson	Contaminants in groundwater and wastewater	Carbon adsorption, air stripping, metals precipitation, oil and water separation, membrane separation and multimedia filtration
Critical Fluid Systems 25 Acorn Park Cambridge, MA 02140 Tel: (617) 492-1631 Contact: Peter Dunlap	Liquids and sludges with organic content from 1 to 30%	High pressure extraction of organic contaminants
DETOX Inc.[1] 64 Marco Lane Dayton, OH 45459 Tel: (513) 433-734 Contact: Evan Nyer	Groundwater, wastewater	Biological, air stripping, and in-situ carbon adsorption, custom treatment systems
DETOXCO[1,2] 2700 Ygnacio Valley Road Walnut Creek, CA Tel: (415) 930-7997 Contact: Robert McMahon	Pesticide-contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration

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[1] Tufts University Center for Environmental Management Survey
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.5

WASTES CONTAINING PESTICIDES

Company Name	Waste Form	Process
GA Technologies[1,2] P.O. Box 85608 San Diego, CA 92138 Tel: (619) 455-3000 Contact: Harold Diot	Pesticide-contaminated solids, liquids, sludges, soils	Thermal treatment by circulating fluidized bed incineration
Int'l Waste Energy Systems[1] 2150 Kienlen Street St. Louis, MO 63121 Tel: (314) 389-7275 Contact: D.C. Brown	Pesticide-contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration
IT Corp[1] 4575 Pacheco Boulevard Martinez, CA 94553 Tel: (415) 228-5100 Contact: Ed Sirota	Organic liquids, solids and sludges	Carbon adsorption systems, inorganic treatment systems
J. M. Huber[1,2] P.O. Box 2831 Borger, TX 79008 Tel: (806) 274-6331 Contact: Jimmy W. Boyd	Pesticide-contaminated solids, liquids, soils	Thermal treatment by pyrolysis (advanced electric reactor)
John Zink Service, Inc.[1] 4401 South Peoria Tulsa, OK 74170 Tel: (918) 747-1371 Contact: Kenneth E. Hastings	Pesticide-contaminated solids, liquids, sludges	Theraml treatment by rotary kiln incineration
Modar, Inc.[1,2] 3200 Wilcrest St., Suite 220 Houston, TX 77042 Tel: (713) 785-5615 Contact: Fred Sieber	Pesticide-contaminated liquids	Thermal treatment by supercritcal water oxidation
TWI[1] 8000 Maryland, Suite 4400 St. Louis, MO 63105 Tel: (314) 727-5040 Contact: A.J. McCoy	Pesticide-contaminated solids, liquids, sludges, soils	Thermal treatment by rotary kiln incineration

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[1] Tufts University Center for Environmental Management Survey.
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.5

WASTES CONTAINING PESTICIDES

Company Name	Waste Form	Process
Vertech Treatment Systems[1] 12000 Pecos Denver, CO 80234 Tel: (393) 452-8800 Contact: Dr. Gerald Rappe	Diluted or concentrated organic aqueous streams	Wet air oxidation followed by biological and carbon adsorption as needed
Westinghouse Plasma Systems[2] P.O. Box 350 Madison, PA 15663 Tel: (412) 722-5600 Contact: Bill Mellili	Pesticide-contaminated liquids	Thermal treatment by pyrolysis (plasma arc)
Westinghouse Hittman Nuclear Inc.[2] P.O. Box 286 Madison, PA 15663 Tel: (412) 722-5600 Contact: Leo P. Duffy	Aqueous liquids, semi-solids	Fixation/solidification by cement-based process
Zimpro, Inc.[1,2] Military Road Rothchild, WI 54474 Tel: (715) 359-7211 Contact: J. Robert Nicholson	Groundwater and wastewater	Activated carbon with biological treatment

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[1] Tufts University Center for Environmental Management Survey.
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.6

WASTES CONTAINING EXPLOSIVES

Company Name	Waste Forms	Process
Bondico Incorporated[1] 2410 Silver Street Jacksonville, FL 32206 Tel: (904) 358-2602 Contact: Mark Shaw	Liquids, sludges, solids	Encapsulate, salvage drums
Shirco Infrared Systems[1,2] 1195 Empire Central Dallas, TX 75247-4301 Tel: (214) 630-7511 Contact: George Hay	Organic-contaminated solids, sludges, soils including explosive wastes	Thermal treatment by infrared incineration

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[1] Tufts University Center for Environmental Management Survey.
[2] EPA OSWER Mobile Unit Inventory

TABLE 2.7

WASTES CONTAINING ASBESTOS

Company Name	Waste Forms	Process
Bethlehem Steel[1] Building H, Room A110 Bethlehem, PA 18106 Tel: (215) 694-2424 Contact: Robert M. McMullen	Sludges and soils	Chemical fixation/solidification process
Envirite Field Services[1,2] 600 Germantown Pike Plymouth Meeting, PA 19462 Tel: (215) 828-8655 Contact: Bill Howard	Sludges and soils	Chemical fixation/solidification
Lopat Enterprises[1] 1750 Bloomsbury Ave. Wanamassa, NJ 07712 Tel: (201) 922-6600 Contact: Lewis Flax	Sludges and soils	Fixation/solidification additive
Solidtek Systems, Inc.[2] 15371 Cook Road Morrow, GA 30260 Tel: (404) 361-6181 Contact: Ed Shuster	Sludges, solids, soils	Fixation/solidification
Veliscol Chemical Corp.[1,2] 2603 Corporate Ave., Suite 100 Memphia, TN 38132 Tel: (901) 345-1788 Contact: Charles Hanson	Sludges and soils	Fixation/solidification
Westinghouse Hittman Nuclear, Inc.[2] 9151 Runsy Road Colombia, MD 21045 Tel: (301) 964-5043 Contact: Robert Conner	Sludges and soils	Fixation/solidification

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[1] Tufts University Center for Environmental Management Survey

[2] EPA OSWER Mobile Unit Inventory.

TABLE 2.8

WASTES CONTAINING CYANIDES

Company Name	Waste Form	Process
ANDCO Environmental Process[2] 595 Commerce Drive Amherst, NY 14150 Tel: (716) 691-2100 Contact: Joseph Duffey	Aqueous cyanide wastes	Reduction-oxidation (redox) reactions will destroy or reduce the toxicity of many toxic organics and heavy metals.
Bondico Incorporated[1,2] 410 Silver Street Jacksonville, FL 32206 Tel: (904) 358-2602 Contact: Mark Shaw	Cyanide in liquids, solids and sludges	Encapsulate, salvage drums
Ensotech, Inc.[1] 1150 Vanowen Street North Hollywood, CA 19605 Tel: (818) 982-4895 Contact: Doug Smith	Cyanide in sludges, aqueous, wastes, soil	Oxidation/reduction, neutralization and precipitation
Rexnord Industries[2] 5103 West Beloit Road Milwaukee, WS 53214 Tel: (414) 643-2762 Contact: Dick Osantowski	Aqueous cyanide wastes industrial wastewater contaminated with electroplating wastes	Carbon adsorption, dewatering, reverse osmosis & alkaline chlorination

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[1] Tufts University Center for Environmental Management Survey

[2] EPA OSWER Mobile Unit Inventory.

TABLE 2.9

WASTES CONTAINING CORROSIVES OR REACTIVES

Company Name	Waste Form	Process
ATW-Calweld[1] 11300 South Norwalk Blvd. Santa Fe Springs, CA 90670 Tel: (213) 929-8103 Contact: John Royle	Corrosives in soils, sludges	Augering system with simultaneous contaminant monitoring. In-situ fixation, biodegradation, or chemical treatment injection system
Chemical Waste Management[2] 150 West 137th Street Riverdale, IL 60627 Tel: (312) 841-8360 Contact: Peter Daley	Corrosives in liquids, sludges, or soils	Neutralization, stabilization
Ensotech, Inc.[1,2] 11550 Vanowen Street North Hollywood, CA 91605 Tel: (818) 982-4895 Contact: Doug Smith	Corrosives in sludges, aqueous wastes, soils	Neutralization, stabilization
Envirochem Waste Mgt.[1,2] Services P.O. Box 10784 Raleigh, NC 27605 Tel: (919) 452-8412 Contact: Jerry Deakle	Contaminated water, acid and bases, cutting oils in sludges	Physical phase separation, acid and base neutralization, polymer flocculation and and separation, carbon filtration
National Dredging & Pumping Co.[1] P.O. Box 127 Folcroft, PA 19032 Tel: (215) 237-0700 Contact: Guy Petroski	Corrosives in liquids, sludges and industrial wastes	Sludge dewatering, physical and chemical stabilization
Solidtek Systems, Inc.[1,2] 5371 Cook Road Morrow, GA 30260 Tel: (404) 361-6181 Contact: Ed Shuster	Acids and bases in liquids, sludges, solids and soil	Neutralization/stabilization

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[1] Tufts University Center for Environmental Management Survey
[2] EPA OSWER Mobile Unit Inventory

SECTION 3
COMPANIES OFFERING BIOLOGICAL PROCESSES

This section presents an inventory of those many companies that currently offer mobile biological treatment systems. Only companies that provided detailed information are included in this section. These systems include mobile tank-based aerobic and anaerobic biodegradation, as well as insitu systems for enhancement of natural soil microbial populations (Table 3.1).

As a general rule, biological systems require stable, consistent operating conditions with little variation in waste stream characteristics. The information presented here will help define the requirements for use of onsite biological systems. Additional considerations such as site preparation, pretreatment, and cost are also addressed. It is important to note that the residuals produced by biological systems will vary significantly according to the characteristics of the waste stream.

The companies included in this inventory will be able to provide information on handling and disposal of sludge residuals. In addition, several companies listed in the section on physical/chemical processes are equipped to dispose of sludges. Immobilization processes may also be applicable to disposal of biological treatment residuals.

TABLE 3.1
COMPANIES OFFERING MOBILE UNITS FOR BIOLOGICAL TREATMENT

Company	Process	Units	Capacity	Waste Type Handled
Dorr-Oliver, Inc.	Aerobic or Anaerobic biological treatment with fixed film or membrane reactor	Up to 8 tank reactors	Maximum of 10,000 gpd	Aerobic: primarily non halogenated organics Anaerobic: some halogenated organics at moderate levels
FMC	In situ enhancement or acceleration of natural bacterial biodegradation	Little equipment required. May use injection system with groundwater recirculation	Site dependent	Primarily readily biodegradable organics in soil or groundwater
Polybac Corp.	Aerobic or anaerobic fixed film reactor	13 tank reactors	6,000 to 25,000 gpd	Most nonhalogenated organics, some halogenated organics
	In situ biodegradation using cultured bacterial strains	Variable - may require groundwater recirculation system	Site dependent	Readily biodegradable organics in soil or groundwater
Zimpro Inc.	Aerobic reactor augmented with powdered activated carbon treatment (PACT)	1 tank reactor	18,000 gpd	Nonhalogenated and halogenated organics, including pesticides

DORR-OLIVER
DORR-OLIVER INCORPORATED

CORPORATE HEADQUARTERS
77 HAVEMEYER LANE
P.O. BOX 9312
STAMFORD, CT 06904-9312
TELEX 965912
TEL. 203-358-3200

May 15, 1986

Mr. Colin W. Baker
Camp Dresser & McKee Inc.
One Center Plaza
Boston, Massachusetts 02108

Dear Colin:

Enclosed is the survey information you requested in your letter to Fred Leonard of Dorr-Oliver on April 7. Information is provided on Dorr-Oliver's fixed-film and suspended growth biological systems for treatment of aqueous wastes. In addition, I have enclosed some information which has been presented to groups at EPA in both Washington and Cincinnati on mobile application of these technologies to treatment of contaminated groundwater.

I hope the information meets your needs at this time and look forward to talking with you further on the subject matter.

Very truly yours,

Paul

Paul M. Sutton
General Manager
Biological Systems

PMS/sy

Enclosures

cc: Fred B. Leonard

SUPERFUND SITE
MOBILE TREATMENT UNITS
BIOLOGICAL PROCESSES SURVEY

DORR-OLIVER

A. General

Company Dorr-Oliver Incorporated

Address 77 Havemeyer Lane

Town Stamford State Connecticut Zip 06904

Contact Person Paul M. Sutton or Fred B. Leonard

B. Process Characteristics

1. Biological treatment processes available in mobile units. Describe briefly. The Oxitron® and Anitron™ mobile/transportable biological treatment systems are respectively the aerobic and anaerobic commercial embodiments of the fluidized bed biological treatment process. The fluidized bed reactor is a highly efficient fixed-film reactor in which biomass build-up occurs on a fluidized support media high in external surface area.

   If your treatment units are significantly different from each other, you may wish to copy this survey and fill out a separate form for each unit.

2. Process unit(s) that comprise mobile system Fluid bed reactor and all associated pumping, controls/instrumentation, etc. Feed tank(s) designed also to act as physical and/or chemical pretreatment step(s). Limited space will be available to add additional unit processes.

3. Optimum system operating parameters

   Temperature range Oxitron 10°-35°C Anitron 25°-40°C

   Solid Residence time Depends on biological treatability of wastewater in question and characteristics of biofilm developed, but generally greater than 20 days.

   Liquid Residence time Depends on biological treatability of wastewater in question and characteristics of biofilm developed, but normally between 10 minutes and 5 hours for Oxitron and 5 hours and 35 hours for Anitron.

   pH range 6.5 to 8.5

   DO range Oxitron 0.5 to 3.0 mg/l Anitron 0 mg/l

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BOD limit Oxitron: Feed concentration less than 1000 mg/l

Anitron: Feed concentration greater than 1000 mg/l and less than 15,000 mg/l for optimal performance.

COD limit Oxitron: No limit provided the refractory COD is not inhibitory to biofilm developed.

Anitron: Greater than 1500 mg/l. No upper limit provided refractory COD is not inhibitory to anaerobic biofilm developed.

Mixed liquor suspended solids Attached volatile solids range normally 8000 to 30,000 mg/l.

Substrate requirements (does optimum operation require input of additional substrate? Under what conditions?)

The nutritional requirements of the biomass may dictate the need for addition of macronutrients (e.g., N and P) and/or micronutrients (e.g., trace metals), depending on availability in feed stream. The nature of the contaminants may also dictate the need for intermittent addition of specialized microbial catalysts.

4. Data on removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful for Superfund site managers. Please provide data on removal efficiencies if available.

Compound	Feed Concentration Range	Restrictions or Limitations	Removal Efficiency
Phenolics	400-600	-	>99%
Toluene	(Date can be provided week of 5/19/86)		
Methyl-ethyl-ketone			
Indole (heterogeneous nitrogenous compound)	5-15	-	>99% (non-detectable in effluent)

4. (Continued)

Compound	Feed Concentration Range	Restrictions or Limitations	Removal Efficiency
Quinoline	5-15	-	>99%
Nitrates as N	10-70		>99% (non-detectable in effluent)

Note: Information is based on results from actual studies. Systems will be applicable to treatment of any compounds which have been shown to be biologically treatable. The fluid bed systems have been applied for treatment of other contaminants in addition to those indicated above (see attached table, page 15). Results, unfortunately, have been expressed in terms of total COD, BOD, N, etc., without determination of specific contaminant concentrations.

5. List any specific site and/or waste characteristics (i.e., quantity, form) that may interfere in the reliable operation of the company's mobil unit(s).

The fixed-film fluid bed reactor is particularly attractive to treatment of soluble contaminants. Although suspended material in the feed can be tolerated, its removal may be limited depending on its characteristics. Continuous feeding of massive levels of suspended matter (greater than 5000 mg/l) or concentrated levels of oil and grease (greater than 500 mg/l) may impair the ability of the fluidized bed reactor to remove soluble material.

6. When is shock loading a problem with the unit?

The fluid bed reactor can be characterized as a fixed-film biological process, with a long solids retention time, a short hydraulic retention time, and normally a significant effluent recycle component. These factors account for the ability of the concept to handle shock loads. The nature and magnitude of the shock loading condition will determine the resulting impact on effluent quality.

7. If mobile unit is often utilized as part of a treatment train, state under what conditions pretreatment is likely to be required prior to input to your mobile unit, and indicate what pretreatment processes would be used.

Answers to questions 2 and 5 are relevant to this question. Pretreatment may be required to reduce the quantity of suspended solids or oil and grease in the feed. Dissolved materials which are deemed toxic to the biological system, such as high concentrations of certain heavy metals, will have to be reduced in concentration.

8. Give the number of mobile units in operation

Current fluid bed units in operation are skid-mounted, transportable units. There are four such units.

9. Give the capacity of each unit

Maximum fluid bed volume of these skid-mounted units is approximately 20 gallons. This will translate into a feed capacity potentially as high as 1800 gallons per day per unit or as low as 10 gallons per day per unit, depending on the waste in question and whether Oxitron or Anitron is the system of choice. Locating two units at one site either operating in parallel or series configuration will at least double treatment capacity.

10. Describe any mobile units under construction or development

Plans are being made for construction of at least one larger transportable mobile unit which will be able to operate in the aerobic (Oxitron) or anaerobic (Anitron) mode. Additional units will be constructed on demand. The capacity of units will be approximately 50 times that of the units described in 9.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now.

The fluid bed systems have been applied on a commercial basis for a number of years but the need has been for permanent installations versus mobile. Examples of performance of commercial units is provided in the enclosed document entitled "Dorr-Oliver/EPA Meetings." Large capacity commercial mobile units such as that described in 10 above will generally be constructed on an "as need" basis.

C. Market Development

12. Your primary market areas Geographically our activity is not limited to any particular area(s).

13. Company goals for market expansion

Our objective is to determine the extent of the market for biological treatment of hazardous, toxic, and otherwise contaminant water, and whether our unique biological systems fit with the market need. If so, we will expand our efforts in order to address this opportunity.

14. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Answers to questions 3, 4 and 5, at least in part, address this question. Oxitron is particularly suited for treating volatile organics in that the problem of air stripping of organics is eliminated and removal is achieved stritcly through biodegradation. The long SRTs achieved in the Oxitron system allow removal of slowly biodegradable compounts. Optional use of granular activated carbon as the fluidized bed media will result in combined biological/carbon treatment. Anitron is best suited for treatment of higher strength organics such as that often associated with landfill leachates.

D. On-Site Utilization

15. Mobilization requirements (time, transport)

Existing (constructed) mobile/transportable units can be transported with in one to two weeks of notification.

16. Utility requirements

A source of water for housekeeping needs and 110 V (and 220 V for larger units) power supply.

17. Site preparation/Space requirements

Smaller units require area of no more than 4 ft by 6 ft per unit. The larger unit(s) (see answer to question 10) will be mounted on a partially enclosed 45 ft long mobile trailer. Site preparation for either unit will simply involve provisions for bringing contaminated water to the unit and taking effluent from the unit.

18. Time/labor requirements to bring unit on-line (including testing)

The units can be put into mechanical operation within one to two days. Process start-up depends on the waste in question, method of biological "seeding", etc. Assuming services are provided for (see answer to question 16), a single operator can bring the units on line.

19. Number of personnel required for operation

One operator.

20. Equipment decontamination required

Unclear as to the meaning of this question.

21. Will the sludge/residuals produced from your mobile unit require further treatment? Illustrate below with examples (halogenated organics, volatiles, volatiles with metals, etc.).

The only residual that may be produced from the mobile unit would be excess biomass. They very long solids retention time characteristic of the fluidized bed process in the treatment of soluble contaminants, means the amount of excess biomass produced in the reactor will be negligible and normally will be accounted for by the suspended solids (15-25 mg/l) in the effluent from the reactor. If excess biomass must be intentionally wasted from the reactor, as indicated by an expansion of the fluidized bed beyond a maximum height, the height of the bed will be reduced by separating sand from biomass, returning the sand to the reactor, and collecting the excess biomass in a holding tank (thickener) provided. Depending on the quantity and characteristics of this excess biomass, it will be slowly bled into the effluent or disposed of off-site in an acceptable manner.

22. Does sludge handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

A holding tank which will act as thickener, is provided to collect excess biomass.

23. Describe any utility requirements for above None.

E. Regulatory Requirements

24. Has your unit(s) ever been permitted by federal, state, or local governments?

No, except for the permanent installations referred to in the answer to question 11.

25. If so, describe type of permit(s) below.

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26. Do you handle permitting of your unit?

Will do so if this is preferred by the client.

27. Average time for approval

Do not know the answer to this question.

28. Information required of client

Do not know the answer to this question.

29. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

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F. Costs

30. This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

31. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BOD, COD)

Essentially, require a problem definition sufficiently thorough to allow: 1) estimation of whether a biological step alone is sufficient to achieve treatment requirements and, 2) estimation of biological treatability of the wastewater contaminants.

32. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

May need to conduct some bench-scale biological assays to confirm expected treatability. May need to perform some other bench-scale tests to estimate effectiveness of any expected wastewater pre-treatment. It is difficult to be absolutely certain that although a wastewater is biologically treatable, that the organisms responsible for biodegradability will form biological films. This is essential to the performance of the fluid bed process as it is with any other fixed-film system.

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

	Leachate Data		
Parameter	Average	High	Pollutant Limitation for Discharge to WWTP (1)
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130(2)

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(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

MOBILE TREATMENT UNIT

COST ANALYSIS

SITE: Leachate Site

COMPONENT: See Note (1)

Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1. Administration	See Note (2)	
2. Equipment	See Note (3)	
3. Permitting	Unknown	
4. Pre-Operationsl Testing	$2,000 to $5,000	
5. Operating Expenses (fuel, treatment additives)	See Note (4)	
6. Mobilization - Demobilization		
(Local - 100 miles)	$1,000 to $5,000	
(Non-Local - 1000 miles)	$5,000 to $10,000	
7. Labor (on-site)	See Note (2)	
8. Laboratory Analyses	Unknown	

9. Volume of Residuals per unit volume of waste

See Note (5)

Treatment requirements for residuals ____________________

____

____

Notes:

(1) It is anticipated that the leachate can be treated by an aerobic fluid bed (Oxitron) mobile unit and the discharge limitations met accordingly. The pre-treatment step included with the mobile unit will be utilized for essentially metal precipitation.

(2) Assuming the unit is owned and operated by Dorr-Oliver and provided to the client on a contractual basis, the estimated contractual cost would be in the range of $125,000 to $175,000 per year of operation. This cost would include administration and on-site labor.

(3) If the unit was bought by the client, the estimated equipment cost would be in the range of $150,000 to $250,000.

(4) Estimated at $10/2000 gallons of wastewater treated, including chemicals for pre-treatment. Does not include utility requirements.

(5) Only significant "residual" will be sludge produced during pre-treatment step for metal precipitation. Jar tests required to determine volume of sludge per volume of waste treated. Material will be disposed of off-site in an acceptable manner.

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

MOBILE TREATMENT UNIT

COST ANALYSIS

SITE: PCB Site

COMPONENT: See Note (1)

Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1. Administration	See Note (2)	
2. Equipment	See Note (3)	
3. Permitting	Unknown	
4. Pre-Operationsl Testing	$2,000 to $5,000	
5. Operating Expenses (fuel, treatment additives)	See Note (4)	
6. Mobilization - Demobilization		
(Local - 100 miles)	$1,000 to $5,000	
(Non-Local - 1000 miles)	$5,000 to $10,000	
7. Labor (on-site)	See Note (2)	
8. Laboratory Analyses	Unknown	

9. Volume of Residuals per unit volume of waste

See Note (5)

Treatment requirements for residuals

Notes:

(1) It is anticipated that the volatile organic groundwater contaminants (benzene, toluene, and TCE) can be treated by an aerobic fluid bed (Oxitron, with sand as the fluidizing media) mobile unit at a feed rate of approximately 12,000 gpd). The treatment will involve biodegradation versus stripping of VOCs due to the characteristics of the Oxitron system (pre-dissolution of O_2.) A contingency if effluent results were not acceptable or treatment capacity was less than 10,000 gpd, would be the replacement of the sand fluidizing media with granular activated carbon.

(2) Assuming the unit is owned and operated by Dorr-Oliver and provided to the client on a contractual basis, the estimated contractual cost would be in the range of $125,000 to $175,000 per year of operation. This cost would include administration and on-site labor.

(3) If the unit was bought by the client, the estimated equipment cost would be in the range of $150,000 to $250,000.

(4) Estimated at $9.00/day not including external addition of any specialized "seed" material that may be required at start-up. Does not include utility requirements.

(5) No residuals are likely to result. Waste characteristics are such that an extremely long SRT will result in the fluid bed reactor.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide

COMPONENT: As Listed

Primary Costs[a]	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Weight of Residuals per day.

300 lbs @ 6.0% total solids; or 45% moist filter cake

Treatment requirements for residuals Liquid discharge: None; Spent carbon/waste activated sludge with filter press dewatering to land deposition; OR carbon regeneration and sludge destruction with wet air regeneration depending on economics of filter pressing/land deposition.

(a) The total costs expressed in 1-8) above will be about 5.0-9.0 cents/gallon processed, including a chemical precipitation step ahead of PACT to remove arsenic.

DORR-OLIVER

EXAMPLES OF MOBILE/TRANSPORTABLE SYSTEM APPLICATIONS

SOURCE	TYPE OF CONTAMINANTS
Automotive Industry	
- Paint solvents	Volatile organic compounds
- Metalworking fluids	Petroleum-based hydrocarbons, glycols, amides, amines, ethers
Chemical/Petrochemical Industry	
- Nuclear fuel processing waters	Ammonia
- Process water from synthetic fiber production	Arcylonitrile and other organics
- Contaminated ground water from manufacture of plastic components	Inorganic nitrogen compounds
- Oil refinery process wastewater	MEK, toluene, methyl pyrrolidon and other organics
Synthetic Fuels	
- Shale oil processing wastewaters	Polycyclic organics, ammonia, organic sulfides, etc.
- Coal liquefaction process wastewaters	Phenols, ammonia, organic nitrogen compounds and other organics
Iron and Steel Industry	
- Coke plant wastes and blast furnace blowdown	Phenols, polyaromatic hydrocarbons, ammonia, etc.
Pulp and Paper Industry	
- NSSC corrugating mill and hardboard mill wastewaters	Organic acids, alcohols, sulfur compounds, etc.
- Sulfite mill condensates	Acetic acid, methanol, furfural, ammonia, sulfur compounds, etc.

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DORR-OLIVER

SUPERFUND SITE
MOBILE TREATMENT UNITS
BIOLOGICAL PROCESSES SURVEY

A. General

Company Dorr-Oliver Incorporated

Address 77 Havemeyer Lane

Town Stamford State Connecticut Zip 06904

Contact Person Paul M. Sutton or Fred B. Leonard

B. Process Characteristics

1. Biological treatment processes available in mobile units. Describe briefly.

   The membrane aerobic/anaerobic reactor system (MARS™) concept involves a suspended growth biological reactor coupled with an ultrafiltration step for biomass separation and recycle. The ultrafiltration step provides absolute retention of reactor biomass resulting in high volumetric efficiency, absolute control of solids retention time, and protection against biomass loss due to changing feed conditions. System can be operated under aerobic or anaerobic environmental conditions.

   If your treatment units are significantly different from each other, you may wish to copy this survey and fill out a separate form for each unit.

2. Process unit(s) that comprise mobile system MARS reactor and membrane unit and all associated pumping, controls/instrumentation, etc. Feed tank(s) designed also to act as physical and/or chemical pretreatment step(s). Limited space will be available to add additional unit processes.

3. Optimum system operating parameters

   Temperature range Aerobic operation 10°-35°C Anaerobic operation 25°-40°C

   Solid Residence time Ability to maintain a high concentration of reactor biomass (greater than 20,000 mg/l VSS) leads to SRTs generally greater than 20 days.

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Liquid Residence time Depends on wastewater feed characteristics, its treatability, and effluent requirements but normally between 2 hours and 10 hours for aerobic operation and 10 hours and 100 hours for anaerobic operation.

pH range 6.5 to 8.5

DO range Aerobic operation 0.5 to 3.0 mg/l Anaerobic operation 0 mg/l

BOD limit Aerobic operation: Feed concentration less than 1000 mg/l
Anaerobic operation: Feed concentration greater than 1000 mg/l (no upper limit).

COD limit Aerobic operation: No limit provided the refractory COD is not inhibitory to biomass development. Anaerobic operation: Greater than 1500 mg/l. No upper limit provided refractory COD is not inhibitory to anaerobic biomass development.

Mixed liquor suspended solids Volatile suspended solids range normally from 15,000 to 30,000 mg/l.

Substrate requirements (does optimum operation require input of additional substrate? Under what conditions?)

The nutritional requirements of the biomass may dictate the need for addition of macronutrients (e.g., N and P) and/or micronutrients (e.g., trace metals), depending on availability in feed stream. The nature of the contaminants may also dictate the need for intermittent addition of specialized microbial catalysts.

4. Data on removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful for Superfund site managers. Please provide data on removal efficiencies if available.

Note: Will be applicable to treatment of any compounds which have been shown to be biologically treatable. In the treatment of sanitary wastewater, BOD_5 has been reduced from 146 to 2 mg/l, NH_4-N from 16.7 to less than 2 mg/l, and SS from 178 mg/l to a non-detectable level. System currently treating metalworking fluid wastewater contaminants (including petroleum-based hydrocarbons, glycols, amides, amines, ethers. Specific removal information not available at this time.

5. List any specific site and/or waste characteristics (i.e., quantity, form) that may interfere in the reliable operation of the company's mobile unit(s).

High concentration of free oil and grease (greater than 500 mg/l). The treatment/removal of suspended material in the feed may limit the SRT attainable in the biological reactor.

6. When is shock loading a problem with the unit?

The absolute protection against biomass loss afforded by the membrane solid-liquid separation step accounts for the ability of the system to withstand shock loading in terms of changes in feed concentrations. In addition, the system employs a high degree of recycle and a complete-mix biological reactor providing feed equalization.

7. If mobile unit is often utilized as part of a treatment train, state under what conditions pretreatment is likely to be required prior to input to your mobile unit, and indicate what pretreatment processes would be used.

Answers to questions 2 and 5 are relevant to this question. Pretreatment may be required to reduce the quantity of suspended solids or oil and grease in the feed. Dissolved materials which are deemed toxic to the biological system, such as high concentrations of certain heavy metals, will have to be reduced in concentration.

8. Give the number of mobile units in operation

Current units in operation are smaller, skid-mounted, transportable units. There are three such units. In addition, there exists one larger transportable unit.

9. Give capacity of each unit

The maximum biological reactor volume of the smaller skid-mounted units is approximately 80 gallons. This will translate into a feed capacity potentially as high as 1900 gallons per day per unit or as low as 20 gallons per day per unit, depending on the waste in question and whether aerobic or anaerobic treatment is applicable. The larger transportable unit contains a variable volume biological reactor providing a feed capacity as high as 10,000 gallons per day, depending on the waste in question and whether aerobic or anaerobic treatment is applicable.

10. Describe any mobile units under construction or development

Additional smaller or larger units will be constructed as required.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now.

The systems have been applied on a commercial basis for a number of years but the need has been for permanent installations versus mobile.

C. Market Development

12. Your primary market areas Geographically our activity is not limited to any particular area(s).

13. Company goals for market expansion

Our objective is to determine the extent of the market for biological treatment of hazardous, toxic, and otherwise contaminant water, and whether our unique biological systems fit with the market need. If so, we will expand our efforts in order to address this opportunity.

14. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

In the context of the SITE program, the MARS technology will be particularly attractive for the treatment of contaminants which may require the development (or external addition) of specialized microbial catalyst in order for the compounds to be metabolized. The absolute protection against biomass loss that the system affords means that any "seed" material added to the reactor will be retained. Absolute control of the reactor SRT results in control of the microbial growth rate affording selective development of desired organisms. Optional external addition of powdered activated carbon will result in combined biological/carbon treatment allowing reduction of both biodegradable and recalcitrant substances.

D. On-Site Utilization

15. Mobilization requirements (time, transport)

The smaller mobile/transportable units can be transported with in one to two weeks of notification. The larger unit may require more time for mobilization.

16. Utility requirements

A source of water for housekeeping needs and 110 V (and 220 V for larger units) power supply.

17. Site preparation/Space requirements

Smaller units require area of no more than 4 ft by 6 ft per unit. The larger unit(s) will be mounted on an enclosed 45 ft long mobile trailer. Site preparation for either unit will simply involve provisions for bringing contaminated water to the unit and taking effluent from the unit.

18. Time/labor requirements to bring unit on-line (including testing)

The units can be put into mechanical operation within one to two days. Process start-up depends on the waste in question, method of biological "seeding", etc. Assuming services are provided for (see answer to question 16), a single operator can bring the units on line.

19. Number of personnel required for operation One operator.

20. Equipment decontamination required

Unclear as to the meaning of this question.

21. Will the sludge/residuals produced from your mobile unit require further treatment? Illustrate below with examples (halogenated organics, volatiles, volatiles with metals, etc.).

The only residual that may be produced from the mobile unit would be excess biomass. The very long solids retention time characteristic of the MARS concept in the treatment of contaminated groundwater means the amount of excess biomass produced in the reactor will be negligible. If biomass is intentionally wasted from the reactor in controlling the microbial growth at a specific level, it will be collected in a holding tank (thickener) provided. Depending on the quantity and characteristics of this excess biomass, it will be slowly bled into the effluent or disposed of off-site in an acceptable manner.

22. Does sludge handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

A holding tank which will act as thickener, is provided to collect excess biomass.

23. Describe any utility requirements for above None.

E. Regulatory Requirements

24. Has your unit(s) ever been permitted by federal, state, or local governments?

No, except for the permanent installations referred to in the answer to question 11.

25. If so, describe type of permit(s) below.

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26. Do you handle permitting of your unit?

Will do so if this is preferred by the client.

27. Average time for approval

Do not know the answer to this question.

28. Information required of client

Do not know the answer to this question.

29. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

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F. Costs

30. This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

31. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BOD, COD)

Essentially, require a problem definition sufficiently thorough to allow: 1) estimation of whether a biological step alone is sufficient to achieve treatment requirements and, 2) estimation of biological treatability of the wastewater contaminants.

32. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

May need to conduct some bench-scale biological assays to confirm expected treatability. May need to perform some other bench-scale tests to estimate effectiveness of any expected wastewater pre-treatment.

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

MOBILE TREATMENT UNIT

COST ANALYSIS

SITE: PCB Site

COMPONENT: See Note (1)

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	See Note (2)	
2.	Equipment	See Note (3)	
3.	Permitting	Unknown	
4.	Pre-Operationsl Testing	$2,000 to $5,000	
5.	Operating Expenses (fuel, treatment additives)	See Note (4)	
6.	Mobilization - Demobilization		
	(Local - 100 miles)	$1,000 to $5,000	
	(Non-Local - 1000 miles)	$5,000 to $10,000	
7.	Labor (on-site)	See Note (2)	
8.	Laboratory Analyses	Unknown	

9. Volume of Residuals per unit volume of waste

See Note (5)

Treatment requirements for residuals

Notes:

(1) It is anticipated that the volatile organic groundwater contaminants (benzene, toluene, and TCE) can be treated by an aerobic fluid bed (Oxitron, with sand as the fluidizing media) mobile unit at a feed rate of approximately 12,000 gpd). The treatment will involve biodegradation versus stripping of VOCs due to the characteristics of the Oxitron system (pre-dissolution of O_2. A contingency if effluent results were not acceptable or treatment capacity was less than 10,000 gpd, would be the replacement of the sand fluidizing media with granular activated carbon.

(2) Assuming the unit is owned and operated by Dorr-Oliver and provided to the client on a contractual basis, the estimated contractual cost would be in the range of $125,000 to $175,000 per year of operation. This cost would include administration and on-site labor.

(3) If the unit was bought by the client, the estimated equipment cost would be in the range of $150,000 to $250,000.

(4) Estimated at $9.00/day not including external addition of any specialized "seed" material that may be required at start-up. Does not include utility requirements.

(5) No residuals are likely to result. Waste characteristics are such that an extremely long SRT will result in the fluid bed reactor.

FMC

SUPERFUND SITE
MOBILE TREATMENT UNITS
BIOLOGICAL PROCESSES SURVEY

A. General

Company FMC Aquifer Remediation Systems

Address Rt 1 & Plainsboro Rd.

Town Princeton State NJ Zip 08540

Contact Person Joan Ridler Telephone (609) 452-2300 (Ex.4208)

B. Process Characteristics

1. Biological treatment processes available in mobile units. Describe briefly.

   Bio XL_{SM}-Insitu enhanced bioreclamation. The stimulation of natural indigenous bacteria populations to biodegrade chemical contaminants in place from groundwater and soil. The treatment process may utilize subsurface injection, infiltration percolation as a means of supplying nutrients to bacterial populations

   If your treatment units are significantly different from each other, you may wish to copy this survey and fill out a separate form for each unit.

2. Process unit(s) that comprise mobile system none

   Units may include injection system

3. Optimum system operating parameters

   Temperature range N/A ambient ground temperature 32^{0} - 80^{0}

   Solid Residence time N/A

   Liquid Residence time N/A

   pH range contingent on site a very wide range of pH concentrations is tolerated if local indigenous bacterial populations thrive under those conditions

   DO range contingent on site

BOD limit N/A

COD limit N/A

Mixed liquor suspended solids N/A

Substrate requirements (does optimum operation require input of additional substrate? Under what conditions?) contingent on site conditions if contaminant levels are very low, additional substrate may be required.

4. Data on removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful for Superfund site managers. Please provide data on removal efficiencies if available.

Compound	Concentration Range	Restrictions or Limitations	Removal Efficiency
most organics	free product	none	ppb ranges
but	dissolved		
not	absorbed		
halogenated			
organics			
Gasoline			
MEK			ppm - ppb range
Alcohol			
amines			

5. List any specific site and/or waste characteristics (i.e., quantity, form) that may interfere in the reliable operation of the company's mobil unit(s).

Ability to move microbial nutrient to contaminated area

Impermeable soils may inhibit hydrological flow of nutrients to microbial populations

6. When is shock loading a problem with the unit? never

7. If mobile unit is often utilized as part of a treatment train, state under what conditions pretreatment is likely to be required prior to input to your mobile unit, and indicate what pretreatment processes would be used.

N/A

8. Give the number of mobile units in operation N/A

9. Give the capacity of each unit: Minimum none Maximum none

10. Describe any mobile units under construction or development

confidential

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now.

5

If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

cost is 5$ to 10$ per pound of contaminant

C. Market Development

12. Your primary market areas confidential

13. Company goals for market expansion confidential

14. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

site specific/under the right conditions every site is good

D. On-Site Utilization

15. Mobilization requirements (time, transport) 1 week

16. Utility requirements electric

17. Site preparation/Space requirements 10-20 ft.(sq.)

18. Time/labor requirement to bring unit on-line (including testing)

N/A

19. Number of personnel required for operation N/A

20. Equipment decontamination required rinse with distilled water several times

21. Will the sludge/residuals produced from your mobile unit require further treatment? Illustrate below with examples (halogenated organics, volatiles, volatiles with metals, etc.).

Primary Contaminants	Sludge Toxicity (high, low)	Type of Further Treatment Required (if any)	Final Method of Disposal
no further treatment needed			

22. Does sludge handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

no

23. Describe any utility requirements for above N/A

E. Regulatory Requirements

24. Has your unit(s) ever been permitted by federal, state, or local governments? __X__ Yes _____ No.

25. If so, describe type of permit(s) below. unknown

26. Do you handle permitting of your unit? _____ Yes __X__ No

27. Average time for approval N/A

28. Information required of client N/A

29. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Rep tape in the buracracy

FMC

F. Costs

30. This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

31. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BOD, COD)

hydrogeological flow rates, soil conditions, amount spilled, what is spilled

32. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

none

- Soil pH, permeability, conductivity, alkalinity
- Aquifer characteristics
- Contaminant characteristics such as presence of heavy metals or chlorinated organics may inhibit bacterial action
- Amount of time available for cleanup (average time needed for process is 6 - 18 months.

Site Scenarios (attached)

33. The following section contains four site scenarios and a cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste components at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be rough and will be used as general guidelines. Please list any factors which could significantly elevate costs. (If mobile unit is applicable to more than one waste component and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

SUPERFUND SITE
MOBILE TREATMENT UNITS
BIOLOGICAL PROCESSES SURVEY

A. General

Company Polybac Corporation

Address 954 Marcon Boulevard

Town Allentown State Pennsylvania Zip 18103

Contact Person Curtis McDowell/William Ronyack Telephone (215) 264-8740

B. Process Characteristics

1. Biological treatment processes available in mobile units. Describe briefly.

Patented Aerated Submerged Fixed Film Reactor marketed under the name CTX and Anaerobic Submerged Fixed Film Reactor marketed under the name CTX-LANOX

If your treatment units are significantly different from each other, you may wish to copy this survey and fill out a separate form for each unit.

2. Process unit(s) that comprise mobile system The basic units can be equipped with pH control systems, nutrient feed systems and clarifiers.

3. Optimum system operating parameters

Temperature range 14°C to 30°C

Solid Residence time N/A

Liquid Residence time 3.5 to 5 hrs. or more depending on waste strength

pH range 6 - 9

DO range Min. 2 mg/l

BOD limit 1.37 lbs. per 1000 ft^2 media surface for secondary treatment

COD limit N/A

Mixed liquor suspended solids N/A

Substrate requirements (does optimum operation require input of additional substrate? Under what conditions?) Substrate should be in the 100/20/5 range of C-N-P. Dechlorination and/or denitrification may require addition of external carbon source.

4. Data on removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful for Superfund site managers. Please provide data on removal efficiencies if available.

Compound	Concentration Range	Restrictions or Limitations	Removal Efficiency
NH_3	1 to >350 mg/l	*	99
Phenol	1 to >300 mg/l	*	99
Formaldehyde	10 to >2000 mg/l	*	99
#2 Fuel Oil	10 to >300 mg/l	*	98
Landfill Leachate	10 to >2000 mg/l	*	99.9
Creosote	10 to >400 mg/l	*	95
Alcohols & Amines	10 to >1000 mg/l	*	99
PCP	2 to >20 mg/l	*	90
Cutting Oils	5 to >300 mg/l	*	90
Ketones	1 to >1000 mg/l	*	99.9

* Actual limits may be significantly higher.

5. List any specific site and/or waste characteristics (i.e., quantity, form) that may interfere in the reliable operation of the company's mobil unit(s).

The question is too vague. Each site is unique and must be evaluated separately. E.G. PCB's, chlorinated pesticides, & heavily nitrated compounds are not destroyed effectively.

6. When is shock loading a problem with the unit? When the flow exceeds either the hydraulic or organic design parameters.

7. If mobile unit is often utilized as part of a treatment train, state under what conditions pretreatment is likely to be required prior to input to your mobile unit, and indicate what pretreatment processes would be used.

Possibly pH adjustment, DAF, Sedimentation, nutrient feed, co-substrate.

8. Give the number of mobile units in operation 13

9. Give the capacity of each unit: Minimum 2 lb BOD/Day Maximum 250 lb BOD/day

Range is from 6,000 gpd to 250,000 gpd.

10. Describe any mobile units under construction or development

All units are commercially available now.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now.

5, smaller units can be installed on flat bed trucks.

If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

Specific inquiries will be handled on a case by case basis. A release of this information by Polybac Corporation is always after our client's consent.

C. Market Development

12. Your primary market areas Mobile systems for spills and remedial biodecontamination

13. Company goals for market expansion Proprietary.

14. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Organics, usually in the mg/l (not ug/l) range. Contaminated ground water treatment, landfill leachate treatment, fuel oil spills, run off water from spill sites.

D. On-Site Utilization

15. Mobilization requirements (time, transport) Units in stock are available immediately. Units that must be fabricated, 6 to 10 weeks.

16. Utility requirements Electricity.

17. Site preparation/Space requirements Depends on the size ordered. Largest units require 60' x 13' each unit.

18. Time/labor requirement to bring unit on-line (including testing) Usually 3 days to start-up, 7-10 days to achieve full performance.

19. Number of personnel required for operation 1/2 man.

20. Equipment decontamination required N/A

21. Will the sludge/residuals produced from your mobile unit require further treatment? Illustrate below with examples (halogenated organics, volatiles, volatiles with metals, etc.).

Primary Contaminants	Sludge Toxicity (high, low)	Type of Further Treatment Required (if any)	Final Method of Disposal
Much to vague. The residuals must be tested to determine ultimate treatment and disposal.			

22. Does sludge handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

Generally no.

23. Describe any utility requirements for above

E. Regulatory Requirements

24. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ___ No.

25. If so, describe type of permit(s) below. Only with consent of Polybac's clients. (State approval for wastewater treatment has been obtained at several permanent installations.)

26. Do you handle permitting of your unit? ___ Yes X No

27. Average time for approval

28. Information required of client

29. Has regulatory approval been a significant time factor in the past? No
Please list issues that the client should be aware of

F. Costs

30. This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

31. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BOD, COD)

Flow, BOD, TSS, TDS, Metal Scan, Polytox Test, Diurnal variations,

rainfall, groundwater monitoring results, water temp., air temp., soil analysis.

32. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Each site is too unique to generalize. Final treatment limits are

generally the most significant cost factor.

Site Scenarios (attached)

33. The following section contains four site scenarios and a cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste components at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be rough and will be used as general guidelines. Please list any factors which could significantly elevate costs. (If mobile unit is applicable to more than one waste component and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

Parameter	Leachate Data Average	 High	Pollutant Limitation for Discharge to WWTP (1)
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130 (2)

---

(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

POLYBAC

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leachate

COMPONENT: pH, Adjustment, Nutrient Feed,
Bio Reactor
Clarifier

Primary Costs	Cost for Site	Cost/Unit Volume of Waste	at 2,000 gpd for 1 year.
1. Administration	$ 5,000.00	$.006/gal.	
2. Equipment	$34,000.00	$.046/gal.	
3. Permitting	N/A	N/A	
4. Pre-Operational Testing	$500.00	$.00068/gal.	
5. Operating Expenses (fuel, treatment additives)	$20.00/Day	.01/gal.	
6. Mobilization - Demobilization			
(Local - 100 miles)	$1,200.00	$.0016/gal.	
(Non-local - 1000 miles)	$2,100.00	$.0028/gal.	
7. Labor (on-site)	$75.00/Day	.037/gal.	
8. Laboratory Analyses	$120.00/wk.	.0085/gal.	

9. Volume of Residuals per unit volume of waste

.1 to .5 lbs. per lb. of B.O.D. Removed

Treatment requirements for residuals possibly dewatering.

ZIMPRO

SUPERFUND SITE
MOBILE TREATMENT UNITS
BIOLOGICAL PROCESSES SURVEY

A. General

Company Zimpro Inc.

Address Military Road

Town Rothschild State Wisconsin Zip 54474

Contact Person J. Robert Nicholson Telephone 1/800-826-1476
715/359-7211

B. Process Characteristics

1. Biological treatment processes available in mobile units. Describe briefly.

Powdered activated carbon technology (PACT). A bio-physical system using adsorptive capacity of powdered activated carbon in conjunction with biological treatment in a single step.

If your treatment units are significantly different from each other, you may wish to copy this survey and fill out a separate form for each unit.

2. Process unit(s) that comprise mobile system aeration-contact tank, final clarifier, aeration equipment/blowers, carbon feed system, sludge storage tankage and recycling/airlift pumps.

3. Optimum system operating parameters

Temperature range 60-100°F

Solid Residence time 5-20 days

Liquid Residence time depends on waste strength (COD, BOD) to maintain required SRT.

pH range 6-9

DO range 1.0-2 ppm; use 3.0 ppm for nitrified effluent.

BOD limit Depends on rate of flow/Aeration-contact

COD limit Depends on rate of flow/Volume is fixed

Mixed liquor suspended solids 7,000-20,000 ppm

Substrate requirements (does optimum operation require input of additional substrate? Under what conditions?) only if nutrient deficient, then add nitrogen phosphorus and trace minerals.

4. Data on removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful for Superfund site managers. Please provide data on removal efficiencies if available.

Compound	Concentration Range	Restrictions or Limitations	Removal Efficiency

organic acids, oxygenated/heteroatomic, halogenated hydrocarbons, organic bases, aromatic hydrocarbons, aliphatic hydrocarbons, leachates, color/odor control, pesticides, herbicides, contaminated groundwater.

All above in liquid form with COD concentrations from 50 to 50,000 mg/1 COD.

Removal efficiencies 90-98% COD reduction depending on waste strength and type.

5. List any specific site and/or waste characteristics (i.e., quantity, form) that may interfere in the reliable operation of the company's mobil unit(s).

High heavy metals concentrations. Concentration will vary depending on specific metal. Carbon will adsorb low concentrations of metals with/without an organic complex of metals.

6. When is shock loading a problem with the unit? See 5) above plus severe hydraulic overloads without proper flow equalization.

7. If mobile unit is often utilized as part of a treatment train, state under what conditions pretreatment is likely to be required prior to input to your mobile unit, and indicate what pretreatment processes would be used.
Use heavy metal precipitation for high metals concentration. Concentration will vary depending on specific metal.

8. Give the number of mobile units in operation one

9. Give the capacity of each unit: Minimum none Maximum 18,000 gpd

Experience to-date shows a
nominal flow rate 12,000 gpd.

10. Describe any mobile units under construction or development

A. Development complete; commercially available

B. None under construction (5/1/86)

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, [✓ (5) commercially available] now.

If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

Contact: J. Robert Nicholson 1/800-826-1476

C. Market Development

12. Your primary market areas Commercial treaters, HW generators

13. Company goals for market expansion Leachates from HW landfills and municipal solid waste landfills.

14. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Waste Type: See 4) above liquid form

Volume: Up to 10,000 gpd depending on waste strength;

nominal 12,000 gpd

D. On-Site Utilization

15. Mobilization requirements (time, transport) Set-up time: 3-4 days; transportable on standard flat-bed trailer; no building required except for carbon storage.

16. Utility requirements 100 amp, 440 V, 3 phase, 60 hertz without carbon regeneration; 200 amp service with regeneration using wet air regeneration.

17. Site preparation/Space requirements floor space 12' by 40' or approximately 500 SF.

18. Time/labor requirement to bring unit on-line (including testing) 5 days

19. Number of personnel required for operation one

20. Equipment decontamination required limited decontamination

21. Will the sludge/residuals produced from your mobile unit require further treatment? Illustrate below with examples (halogenated organics, volatiles, volatiles with metals, etc.).

Primary Contaminants	Sludge Toxicity (high, low)	Type of Further Treatment Required (if any)	Final Method of Disposal
Liquid Discharge:	None		
Spent Carbon/Waste Activated Sludge:		Yes; material is dewatered on filter press to 45% total suspended solids and suitable for landfill deposition. Also carbon can be regenerated for reuse	

and sludge destroyed with a wet air regeneration system...ash is removed periodically.

22. Does sludge handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

A. Liquid discharge: No

B. Spent carbon/sludge using filter press: No

C. Carbon regeneration/sludge destruction: Yes...economic evaluation between B) and C).

23. Describe any utility requirements for above Power for 22 C) above.

E. Regulatory Requirements

24. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ____ No.

25. If so, describe type of permit(s) below. Federal and states of Michigan, California and Wisconsin.

26. Do you handle permitting of your unit? X Yes ____ No

27. Average time for approval 4-6 weeks

28. Information required of client Site location, waste characteristics and volume, location of sewers, any other on-site waste treatment (owned by client) water courses and air discharge requirements for PACT aeration (VOC)* and emissions from wet air regeneration.

29. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Michigan site - 4 weeks to satisfy effluent/air (VOC) discharge requirements

California site - 8 months to satisfy air (VOC) discharge requirements

Wisconsin site - 12 months for RCRA Part B permit

*VOC emissions from PACT aeration have not been a problem, but regulatory examination, evaluation and approval is needed.

F. Costs

30. This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

31. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BOD, COD) Require rate of liquid flow, COD and BOD of waste plus a 1-5 gallon sample for our waste characteristics. Also need any effluent discharge requirements.

32. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Heavy metals concentrations; suspended solids concentration

Site Scenarios (attached)

33. The following section contains four site scenarios and a cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste components at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be rough and will be used as general guidelines. Please list any factors which could significantly elevate costs. (If mobile unit is applicable to more than one waste component and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

ZIMPRO

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leachate

COMPONENT: As listed

Primary Costs[a]	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Weight of Residuals per day.

100 lbs. @ 6.0% total solids; OR 45% moist filter cake

Treatment requirements for residuals Liquid discharge: None; Spent Carbon/ Waste activated sludge with filter press dewatering to land deposition OR carbon regeneration and sludge destruction with wet air regeneration depending on economics of filter pressing/land deposition.

(a) PACT can be applied to this scenario. The total costs expressed in 1-8) above will be about 35.0 cents/gallon processed assuming at least one year on-site with mobile PACT system.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Heavy Metals

COMPONENT: As Listed

Primary Costs(a)	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals

(a) No application for PACT. PACT can adsorb the heavy metals with these concentrations, but the heavy concentration of soil will interfere. Phase two, the concentrations are too dilute - granular carbon columns better.

ZIMPRO

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB

COMPONENT: Volatile organic groundwater

Primary Costs [(a)]	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Weight of Residuals per day.

300 lbs @ 6.0% total solids; OR 45% moist filter cake

Treatment requirements for residuals Liquid discharge: None; Spent carbon/ waste activated sludge with filter press dewatering to land deposition OR carbon regeneration and sludge destruction with wet air regeneration depending on economics of filter pressing/land deposition.

(a) The total costs expressed in 1-8) above will be about 5.0 to 9.0 cents/gallon processed.

SECTION 4
COMPANIES OFFERING CHEMICAL/PHYSICAL PROCESSES

This section presents an inventory of many companies that currently offer mobile physical and/or chemical treatment systems. Only those companies that provided detailed technical information are included in this section. Chemical/physical process include a large number of treatment systems, many of which are specific to a particular waste type. A list of some of these systems is provided below.

Chemical Processes

Reduction-Oxidation
Neutralization
Precipitation
Dechlorination

Physical Processes

Air Stripping
Steam Stripping
Distillation
Activated Carbon Adsorption
Evaporation/Dewatering
Soil Flushing /Soil Washing
Filtration
Ion Exchange
Membrane Separation
Phase Separation

Because a large number of processes are described in this section, generalizations about cost or treatment requirements are difficult to make. In addition, generation of residuals and their disposal requirements cannot be accurately estimated without a thorough analyses of waste characteristics and a well-defined treatment train.

Most of the processes described here are conventional treatment technologies adapted for mobile systems. Several firms can readily develop custom mobile treatment systems using conventional physical/chemical processes. Some of the companies included in the inventory appear to be expanding their capability in developing mobile systems to be used in the field. Those systems will likely be used with increasing frequency.

The following summary table (Table 4.1) describes the companies that offer mobile systems for chemical/physical treatment. In some cases, detailed information is provided on a single treatment process (e.g., phase separation) that is only one component of a multi-step treatment train.

TABLE 4.1
COMPANIES OFFERING MOBILE UNITS FOR CHEMICAL/PHYSICAL TREATMENT

Company	Waste	Process	Number of Units	Capacity of Unit
Andco Environmental Processes, Inc.	Heavy metals	Electrochemical production of oxidation/reduction reactants used for precipitation	1	3-50 gpm
Calgon Carbon Corp.	Aqueous wastes with organics	Activated carbon adsorption	Variable 6-10	1-3,000 gpm
Chemical Waste Management, Inc.	Wastewater with chelated metals	Oxidation, precipitation, sedimentation/filtration	1	1-70 gpm
	PCB-contaminated oils	Chemical dechlorination of PCBs	1	3-7 gpm
	Aqueous wastes with organics	Activated carbon adsorption	1	125-250 gpm
Enviro-Chem Waste Management Service	Organically contaminated water, acids and bases, cutting oils	Physical phase separation, acid and base neutralization, polymer flocculation and separation, carbon filtration	1	1-4 gpm
Industrial Innovations, Inc.	Slurries or viscous solids, oils	Physical phase separation, centrifuge processing, vaccum filtration	1	100-200 gpm
Kipin Industries, Inc.	Limited volatiles with boiling points under 1200°F	Liquid stripper/vaporizer	1	5-100 gpm
	Sludges, tank bottoms, solids with low Btu value	Chemical treatment	1	2-100 tons per hour
	Soils contaminated with organics having a boiling point below 1000°F	Roaster/dryer	1	0-50 tons per hour

TABLE 4.1 (Cont'd)
COMPANIES OFFERING MOBILE UNITS FOR CHEMICAL/PHYSICAL TREATMENT

Company	Waste	Process	Number of Units	Capacity of Unit
Mobil Solvent Reclaimers, Inc.	Liquid industrial solvents	Distillation	1	0.8 gpm
Rexnord, Inc.	Groundwater, wastewater contaminated with volatile organics and metals	Carbon adsorption, dewatering, reverse osmosis and alkaline chlorination	1	1-10 gpm
Terra Vac, Inc.	Soils contaminated with volatile organics	Vaccum extraction (air stripping)	6	10,000-400,000 ft^3 of soil
Tetra Recovery Systems	Oily waste	Centrifuge	1	0-100 gpm
	Suspended solids in an aqueous solution	Filter press	3	0-2 yd^3
	Sludges	Sludge dewatering filter press	2	0-2 yd^3
	Contaminated wastewater	Neutralization, polymer flocculation, metal reductions, separation	2	100-150 gpm

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company ANDCO ENVIRONMENTAL PROCESSES, INC.

Address 595 Commerce Drive

Town Amherst State New York Zip 14150

Contact Person Joseph G. Duffey Telephone 716/691-2100

1. Treatment processes available in mobile units

Electrochemical heavy metal removal process and electrochemical fluoride removal process for wastewater and groundwater treatment.

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available One

3. Capacity of each unit: Minimum 3 GPM Maximum 50 GPM

(Give Units) Minimum Maximum

Minimum Maximum

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

The electrochemical unit is designed to remove heavy metals such as chrome, copper, nickel, lead, zinc, tin, etc. using carbon steel electrodes. By changing the electrodes to aluminum, fluoride can be removed from water. Total heavy metals concentration should not exceed 50 mg/l and fluoride around 10 mg/l. The mobile treatment unit is complete with pH control to adjust the influent water to a neutral pH before treatment. A pump is available to transfer water to the system.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

The only reagents necessary are acid or alkali in the event the water is not at a neutral pH. The carbon steel electrodes are consumable and require replacement only every three or four weeks.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

The electrochemical heavy metal removal system will remove hexavalent chrome to 0.05 mg/l and all other heavy metals to EPA requirements. Fluorides can be removed to as low as 1 mg/l.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

The mobile unit is designed to treat the water but does not have a clarifier for solids removal. Filtered samples on the effluent determine the efficiency of treatment.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.)

The electrochemical system operates at ambient temperature, 25 psig, with a residence time of about five seconds.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

No pretreatment is needed before the Andco unit.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

The electrochemical process is commercially available now and there are over 150 Andco units in operation, some with 14 years experience. A partial users list is attached. Some units operate as high as 2000 gpm.

11. Describe any mobile units under construction or development

We have one mobile unit available at this time, but others could be constructed within three months.

12. Market Development

What industry does your mobile treatment technology principally service?

The electrochemical heavy metal removal process has been applied to groundwater treatment, electroplating waste, printed circuit board waste, and cooling tower blowdown water.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No. ? If so, where

14. Are you presently pursuing hazardous waste site market?

Yes, the groundwater treatment problem for heavy metal removal is an excellent application of the Andco electrochemical technology.

15. What are the major impediments to making your mobile technology available for site clean-up work.

The mobile unit does not presently have a clarifier or filter press for solids removal but this could be added easily.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

The present mobile unit is immediately available.

17. Additional time required for on-site testing One day.

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

220 volt or 440 volt power is needed using 10 amps at 220 volts.

19. If required utilities are not available at site, can you provide them?

Power is the only utility required.

20. Specify site preparation/space requirements

The unit is approximately five feet by ten feet by eight feet high. It should be placed indoors in a freezing climate.

21. Number of personnel required for operation One hour labor in 24 hours is needed.

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

Sludge removal and disposal is not provided.

23. What residuals are produced from your mobile unit.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Sludge	Metal Hydroxides	Dewatering	Landfill

24. Specify utility requirements for above

10 amps at 220 volts.

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

The mobile treatment unit is excellent for groundwater treatment and industrial wastewater treatment.

26. Has your unit(s) ever been permitted by federal, state, or local governments? __X__ Yes ______ No.

27. If so, describe type of permit(s) below.

Over 150 units have been installed with appropriate State approvals obtained.

28. Do you handle permitting of your unit? X Yes ______ No

29. Average time for approval One month.

30. Information required of client Analysis of influent water and flowrate and required effluent analysis.

31. Has regulatory approval been a significant time factor in the past? No.
Please list issues that the client should be aware of

Client should be familiar with effluent regulations and permit requirements.

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Flow and analysis of influent water along with effluent requirements.

33. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties?

We should be advised of the space available and the electric power characteristics.

Site Scenarios and Cost Analysis

34. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

The Andco electrochemical process can be used effectively on the "leachate site" and the "heavy metal site".

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

Parameter	Leachate Data		Pollutant Limitation for Discharge to WWTP (1)
	Average	High	
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130 (2)

---

(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

Scenario

Heavy Metals Site

The Heavy Metals Site is approximately 65 acres in size. Much of the site is of open fields and wooded side hills but at the foot of the hills is a manufacturing building complex. For many years various kinds of dyes were produced and dye waste containing large quantities of mercury were pumped from the buildings to lagoons on higher ground. At times the high level lagoons filled and overflowed sending mercury sludges down the side hill to wetlands adjacent the manufacturing buildings. Over the years, other liquid wastes in addition to the sludge overflows were discharged to the wetlands. As a result, the groundwater at the site has become heavily contaminated.

Remediation of the soil at the site requires removal or on-site treatment of the contaminated soil and the sludge filled lagoons. It has been estimated that approximately 35,000 cubic yards of contaminated soils are contained in the wetlands and that the old lagoons contain approximately 75,000 cubic yards of sludge and soil. Analysis of soil samples generally give the following results:

	ug/g Dry Wgt. Basis				
	Hg	Cd	Cr	Pb	pH
Lagoon sludge and soil	210	0.3	60	52	7.2
Wetlands	2,200	1.6	320	210	6.0

Despite a relatively high seasonal ground water table, the mercury has been found to be only moderately mobile as shown by water samples from monitoring wells.

Concern has been expressed about possible release of vaporous mercury as a result of excavation or turning over the contaminated soils, particularly since the nearby industrial buildings are occupied with businesses that are unable to shut down to accommodate the cleanup.

The second phase of the remediation will concentrate on cleanup of the groundwater. Several monitoring wells have been installed and sampled. Typical analyses for on-site wells are shown below. Monitoring wells are typically a total of 50 ft deep, 30 ft into rock. Pumping tests of the wells yielded about 100 gpm with static levels at about 10 ft. Volume to be treated is approximately 20,000 gpd for five years. Contaminants include:

Vinyl chloride	121 ppb
Benzene	50 ppb
Chromium	10 ppm

Elevated levels of iron and manganese are also present.

ANDCO

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leachate Site

COMPONENT: Heavy Metal Removal

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration		
2.	Equipment	$300/Day	
3.	Permitting		
4.	Pre-Operational Testing		
5.	Operating Expenses (fuel, treatment additives)		$1/Day
6.	Mobilization - Demobilization		
	(Local - 100 miles)		
	(Non-local - 1000 miles)		
7.	Labor (on-site)	$15/Day	
8.	Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

one lb./day of metal hydroxides (dry basis)

Treatment requirements for residuals

Clarifier and filter press could result in sludge amounting to 0.04 cubic feet per day as 30% solids.

The mobile Andco Electrochemical Heavy Metal Removal System rents for $300/day plus transportation costs and labor. The unit could be purchased from Andco for this application for less than $100,000 including the clarifier and filter press.

ANDCO

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Heavy Metals Site

COMPONENT: Heavy Metal Removal from Groundwater

Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment	$300/Day	
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		$2/Day
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)	$15/Day	
8. Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

15 lbs./day of metal hydroxides (dry basis).

Treatment requirements for residuals

Clarification and filtration would result in 0.6 cubic feet per day of sludge as 30% solids.

The mobile unit could treat the 20,000 gallons per day. The clarifier and filter press should be added for continuous operation. We would recommend purchase of a commercial unit for the 20,000 gallons per day including clarification and filtration, which would cost approximately $125,000.

FMC

SUPERFUND SITE
MOBILE TREATMENT UNITS
BIOLOGICAL PROCESSES SURVEY

A. General

Company FMC Aquifer Remediation Systems

Address Rt 1 & Plainsboro Rd.

Town Princeton State NJ Zip 08540

Contact Person Joan Ridler Telephone (609) 452-2300 (Ex.4208)

B. Process Characteristics

1. Biological treatment processes available in mobile units. Describe briefly.

Bio XL$_{SM}$-Insitu enhanced bioreclamation. The stimulation of natural indigenous bacteria populations to biodegrade chemical contaminants in place from groundwater and soil. The treatment process may utilize subsurface injection, infiltration percolation as a means of supplying nutrients to bacterial populations

If your treatment units are significantly different from each other, you may wish to copy this survey and fill out a separate form for each unit.

2. Process unit(s) that comprise mobile system none

Units may include injection system

3. Optimum system operating parameters

Temperature range N/A ambient ground temperature 32° - 80°

Solid Residence time N/A

Liquid Residence time N/A

pH range contingent on site a very wide range of pH concentrations is tolerated if local indigenous bacterial populations thrive under those conditions

DO range contingent on site

11-17

BOD limit N/A

COD limit N/A

Mixed liquor suspended solids N/A

Substrate requirements (does optimum operation require input of additional substrate? Under what conditions?) contingent on site conditions if contaminant levels are very low, additional substrate may be required.

4. Data on removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful for Superfund site managers. Please provide data on removal efficiencies if available.

Compound	Concentration Range	Restrictions or Limitations	Removal Efficiency
most organics	free product	none	ppb ranges
but	dissolved		
not	absorbed		
halogenated			
organics			
Gasoline			
MEK			ppm - ppb range
Alcohol			
amines			

5. List any specific site and/or waste characteristics (i.e., quantity, form) that may interfere in the reliable operation of the company's mobil unit(s).

Ability to move microbial nutrient to contaminated area

Impermeable soils may inhibit hydrological flow of nutrients to microbial populations

6. When is shock loading a problem with the unit? never

7. If mobile unit is often utilized as part of a treatment train, state under what conditions pretreatment is likely to be required prior to input to your mobile unit, and indicate what pretreatment processes would be used.

N/A

8. Give the number of mobile units in operation N/A

9. Give the capacity of each unit: Minimum none Maximum none

10. Describe any mobile units under construction or development

confidential

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now.

5

If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

cost is $5^{\$}$ to $10^{\$}$ per pound of contaminant

C. Market Development

12. Your primary market areas confidential

13. Company goals for market expansion confidential

14. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

site specific/under the right conditions every site is good

D. On-Site Utilization

15. Mobilization requirements (time, transport) 1 week

16. Utility requirements electric

17. Site preparation/Space requirements 10-20 ft.(sq.)

18. Time/labor requirement to bring unit on-line (including testing)

N/A

19. Number of personnel required for operation N/A

20. Equipment decontamination required rinse with distilled water several times

21. Will the sludge/residuals produced from your mobile unit require further treatment? Illustrate below with examples (halogenated organics, volatiles, volatiles with metals, etc.).

Primary Contaminants	Sludge Toxicity (high, low)	Type of Further Treatment Required (if any)	Final Method of Disposal
no further treatment needed			

22. Does sludge handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

no

23. Describe any utility requirements for above N/A

E. Regulatory Requirements

24. Has your unit(s) ever been permitted by federal, state, or local governments? _X_ Yes ____ No.

25. If so, describe type of permit(s) below. unknown

26. Do you handle permitting of your unit? ____ Yes _X_ No

27. Average time for approval N/A

28. Information required of client N/A

29. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Rep tape in the buracracy

F. Costs

30. This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

31. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BOD, COD)

hydrogeological flow rates, soil conditions, amount spilled, what is spilled

32. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

none

- Soil pH, permeability, conductivity, alkalinity
- Aquifer characteristics
- Contaminant characteristics such as presence of heavy metals or chlorinated organics may inhibit bacterial action
- Amount of time available for cleanup (average time needed for process is 6 - 18 months.

Site Scenarios (attached)

33. The following section contains four site scenarios and a cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste components at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be rough and will be used as general guidelines. Please list any factors which could significantly elevate costs. (If mobile unit is applicable to more than one waste component and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

SUPERFUND SITE
MOBILE TREATMENT UNITS
BIOLOGICAL PROCESSES SURVEY

A. General

Company Polybac Corporation

Address 954 Marcon Boulevard

Town Allentown State Pennsylvania Zip 18103

Contact Person Curtis McDowell/William Ronyack Telephone (215) 264-8740

B. Process Characteristics

1. Biological treatment processes available in mobile units. Describe briefly.

Patented Aerated Submerged Fixed Film Reactor marketed under the name CTX and Anaerobic Submerged Fixed Film Reactor marketed under the name CTX-LANOX

If your treatment units are significantly different from each other, you may wish to copy this survey and fill out a separate form for each unit.

2. Process unit(s) that comprise mobile system The basic units can be equipped with pH control systems, nutrient feed systems and clarifiers.

3. Optimum system operating parameters

Temperature range 14°C to 30°C

Solid Residence time N/A

Liquid Residence time 3.5 to 5 hrs. or more depending on waste strength

pH range 6 - 9

DO range Min. 2 mg/l

BOD limit 1.37 lbs. per 1000 ft^2 media surface for secondary treatment

COD limit N/A

Mixed liquor suspended solids N/A

Substrate requirements (does optimum operation require input of additional substrate? Under what conditions?) Substrate should be in the 100/20/5 range of C-N-P. Dechlorination and/or denitrification may require addition of external carbon source.

4. Data on removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful for Superfund site managers. Please provide data on removal efficiencies if available.

Compound	Concentration Range	Restrictions or Limitations	Removal Efficiency
NH_3	1 to >350 mg/l	*	99
Phenol	1 to >300 mg/l	*	99
Formaldehyde	10 to >2000 mg/l	*	99
#2 Fuel Oil	10 to >300 mg/l	*	98
Landfill Leachate	10 to >2000 mg/l	*	99.9
Creosote	10 to >400 mg/l	*	95
Alcohols & Amines	10 to >1000 mg/l	*	99
PCP	2 to >20 mg/l	*	90
Cutting Oils	5 to >300 mg/l	*	90
Ketones	1 to >1000 mg/l	*	99.9

* Actual limits may be significantly higher.

5. List any specific site and/or waste characteristics (i.e., quantity, form) that may interfere in the reliable operation of the company's mobil unit(s).

The question is too vague. Each site is unique and must be evaluated separately. E.G. PCB's, chlorinated pesticides, & heavily nitrated compounds are not destroyed effectively.

6. When is shock loading a problem with the unit? When the flow exceeds either the hydraulic or organic design parameters.

7. If mobile unit is often utilized as part of a treatment train, state under what conditions pretreatment is likely to be required prior to input to your mobile unit, and indicate what pretreatment processes would be used.

Possibly pH adjustment, DAF, Sedimentation, nutrient feed, co-substrate.

8. Give the number of mobile units in operation 13

9. Give the capacity of each unit: Minimum 2 lb BOD/Day Maximum 250 lb BOD/day

Range is from 6,000 gpd to 250,000 gpd.

10. Describe any mobile units under construction or development

All units are commercially available now.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now.

5, smaller units can be installed on flat bed trucks.

If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

Specific inquiries will be handled on a case by case basis. A release of this information by Polybac Corporation is always after our client's consent.

C. Market Development

12. Your primary market areas Mobile systems for spills and remedial biodecontamination

13. Company goals for market expansion Proprietary.

14. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Organics, usually in the mg/l (not ug/l) range. Contaminated ground water treatment, landfill leachate treatment, fuel oil spills, run off water from spill sites.

D. On-Site Utilization

15. Mobilization requirements (time, transport) Units in stock are available immediately. Units that must be fabricated, 6 to 10 weeks.

16. Utility requirements Electricity.

17. Site preparation/Space requirements Depends on the size ordered. Largest units require 60' x 13' each unit.

18. Time/labor requirement to bring unit on-line (including testing) Usually 3 days to start-up, 7-10 days to achieve full performance.

19. Number of personnel required for operation 1/2 man.

20. Equipment decontamination required N/A

21. Will the sludge/residuals produced from your mobile unit require further treatment? Illustrate below with examples (halogenated organics, volatiles, volatiles with metals, etc.).

Primary Contaminants	Sludge Toxicity (high, low)	Type of Further Treatment Required (if any)	Final Method of Disposal

Much to vague. The residuals must be tested to determine ultimate treatment and disposal.

22. Does sludge handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

Generally no.

23. Describe any utility requirements for above -

E. Regulatory Requirements

24. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ___ No.

25. If so, describe type of permit(s) below. Only with consent of Polybac's clients. (State approval for wastewater treatment has been obtained at several permanent installations.)

26. Do you handle permitting of your unit? ___ Yes X No

27. Average time for approval

28. Information required of client

29. Has regulatory approval been a significant time factor in the past? No
Please list issues that the client should be aware of

F. Costs

30. This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

31. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BOD, COD)

Flow, BOD, TSS, TDS, Metal Scan, Polytox Test, Diurnal variations,

rainfall, groundwater monitoring results, water temp., air temp., soil analysis.

32. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Each site is too unique to generalize. Final treatment limits are

generally the most significant cost factor.

Site Scenarios (attached)

33. The following section contains four site scenarios and a cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste components at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be rough and will be used as general guidelines. Please list any factors which could significantly elevate costs. (If mobile unit is applicable to more than one waste component and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

Parameter	Leachate Data		Pollutant Limitation for Discharge to WWTP (1)
	Average	High	
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130(2)

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(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

POLYBAC

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leachate

COMPONENT: pH, Adjustment, Nutrient Feed,
Bio Reactor
Clarifier

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste	
				at 2,000 gpd for 1 year.
1.	Administration	$ 5,000.00	$.006/gal.	
2.	Equipment	$34,000.00	$.046/gal.	
3.	Permitting	N/A	N/A	
4.	Pre-Operational Testing	$500.00	$.00068/gal.	
5.	Operating Expenses (fuel, treatment additives)	$20.00/Day	.01/gal.	
6.	Mobilization - Demobilization			
	(Local - 100 miles)	$1,200.00	$.0016/gal.	
	(Non-local - 1000 miles)	$2,100.00	$.0028/gal.	
7.	Labor (on-site)	$75.00/Day	.037/gal.	
8.	Laboratory Analyses	$120.00/wk.	.0085/gal.	

9. Volume of Residuals per unit volume of waste

.1 to .5 lbs. per lb. of B.O.D. Removed

Treatment requirements for residuals possibly dewatering.

SUPERFUND SITE
MOBILE TREATMENT UNITS
BIOLOGICAL PROCESSES SURVEY

A. General

Company Zimpro Inc.

Address Military Road

Town Rothschild State Wisconsin Zip 54474

Contact Person J. Robert Nicholson Telephone 1/800-826-1476
715/359-7211

B. Process Characteristics

1. Biological treatment processes available in mobile units. Describe briefly.

Powdered activated carbon technology (PACT). A bio-physical system using adsorptive capacity of powdered activated carbon in conjunction with biological treatment in a single step.

If your treatment units are significantly different from each other, you may wish to copy this survey and fill out a separate form for each unit.

2. Process unit(s) that comprise mobile system aeration-contact tank, final clarifier, aeration equipment/blowers, carbon feed system, sludge storage tankage and recycling/airlift pumps.

3. Optimum system operating parameters

Temperature range 60-100°F

Solid Residence time 5-20 days

Liquid Residence time depends on waste strength (COD, BOD) to maintain required SRT.

pH range 6-9

DO range 1.0-2 ppm; use 3.0 ppm for [illegible] nitrified effluent.

BOD limit Depends on rate of flow/Aeration-contact

COD limit Depends on rate of flow/Volume is fixed

Mixed liquor suspended solids 7,000-20,000 ppm

Substrate requirements (does optimum operation require input of additional substrate? Under what conditions?) only if nutrient deficient, then add nitrogen phosphorus and trace minerals.

4. Data on removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful for Superfund site managers. Please provide data on removal efficiencies if available.

Compound	Concentration Range	Restrictions or Limitations	Removal Efficiency

organic acids, oxygenated/heteroatomic, halogenated hydrocarbons, organic bases, aromatic hydrocarbons, aliphatic hydrocarbons, leachates, color/odor control, pesticides, herbicides, contaminated groundwater.

All above in liquid form with COD concentrations from 50 to 50,000 mg/l COD.

Removal efficiencies 90-98% COD reduction depending on waste strength and type.

5. List any specific site and/or waste characteristics (i.e., quantity, form) that may interfere in the reliable operation of the company's mobil unit(s).

High heavy metals concentrations. Concentration will vary depending on specific metal. Carbon will adsorb low concentrations of metals with/without an organic complex of metals.

6. When is shock loading a problem with the unit? See 5) above plus severe hydraulic overloads without proper flow equalization.

7. If mobile unit is often utilized as part of a treatment train, state under what conditions pretreatment is likely to be required prior to input to your mobile unit, and indicate what pretreatment processes would be used.

Use heavy metal precipitation for high metals concentration. Concentration will vary depending on specific metal.

8. Give the number of mobile units in operation one

9. Give the capacity of each unit: Minimum none Maximum 18,000 gpd

Experience to-date shows a nominal flow rate 12,000 gpd.

10. Describe any mobile units under construction or development

A. Development complete; commercially available

B. None under construction (5/1/86)

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, [✓ (5) commercially available] now.

If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

Contact: J. Robert Nicholson 1/800-826-1476

C. Market Development

12. Your primary market areas Commercial treaters, HW generators

13. Company goals for market expansion Leachates from HW landfills and municipal solid waste landfills.

14. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Waste Type: See 4) above liquid form

Volume: Up to 10,000 gpd depending on waste strength;

nominal 12,000 gpd

D. On-Site Utilization

15. Mobilization requirements (time, transport) Set-up time: 3-4 days; transportable on standard flat-bed trailer; no building required except for carbon storage.

16. Utility requirements 100 amp, 440 V, 3 phase, 60 hertz without carbon regeneration; 200 amp service with regeneration using wet air regeneration.

17. Site preparation/Space requirements floor space 12' by 40' or approximately 500 SF.

18. Time/labor requirement to bring unit on-line (including testing) 5 days

19. Number of personnel required for operation one

20. Equipment decontamination required limited decontamination

21. Will the sludge/residuals produced from your mobile unit require further treatment? Illustrate below with examples (halogenated organics, volatiles, volatiles with metals, etc.).

Primary Contaminants	Sludge Toxicity (high, low)	Type of Further Treatment Required (if any)	Final Method of Disposal
Liquid Discharge:	None		
Spent Carbon/Waste Activated Sludge:		Yes; material is dewatered on filter press to 45% total suspended solids and suitable for landfill deposition. Also carbon can be regenerated for reuse	

and sludge destroyed with a wet air regeneration system...ash is removed periodically.

22. Does sludge handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

A. Liquid discharge: No

B. Spent carbon/sludge using filter press: No

C. Carbon regeneration/sludge destruction: Yes...economic evaluation between B) and C).

23. Describe any utility requirements for above Power for 22 C) above.

E. Regulatory Requirements

24. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ___ No.

25. If so, describe type of permit(s) below. Federal and states of Michigan, California and Wisconsin.

26. Do you handle permitting of your unit? X Yes ___ No

27. Average time for approval 4-6 weeks

28. Information required of client Site location, waste characteristics and volume, location of sewers, any other on-site waste treatment (owned by client) water courses and air discharge requirements for PACT aeration (VOC)* and emissions from wet air regeneration.

29. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Michigan site - 4 weeks to satisfy effluent/air (VOC) discharge requirements

California site - 8 months to satisfy air (VOC) discharge requirements

Wisconsin site - 12 months for RCRA Part B permit

*VOC emissions from PACT aeration have not been a problem, but regulatory examination, evaluation and approval is needed.

F. Costs

30. This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

31. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BOD, COD) Require rate of liquid flow. COD and BOD of waste plus a 1-5 gallon sample for our waste characteristics. Also need any effluent discharge requirements.

32. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Heavy metals concentrations; suspended solids concentration

Site Scenarios (attached)

33. The following section contains four site scenarios and a cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste components at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be rough and will be used as general guidelines. Please list any factors which could significantly elevate costs. (If mobile unit is applicable to more than one waste component and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leachate

COMPONENT: As listed

Primary Costs (a)	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Weight of Residuals per day.

100 lbs. @ 6.0% total solids; OR 45% moist filter cake

Treatment requirements for residuals Liquid discharge: None; Spent Carbon/ Waste activated sludge with filter press dewatering to land deposition OR carbon regeneration and sludge destruction with wet air regeneration depending on economics of filter pressing/land deposition.

(a) PACT can be applied to this scenario. The total costs expressed in 1-8) above will be about 35.0 cents/gallon processed assuming at least one year on-site with mobile PACT system.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Heavy Metals

COMPONENT: As Listed

Primary Costs[(a)]	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals

(a) No application for PACT. PACT can adsorb the heavy metals with these concentrations, but the heavy concentration of soil will interfere. Phase two, the concentrations are too dilute - granular carbon columns better.

ZIMPRO

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB

COMPONENT: Volatile organic groundwater

Primary Costs (a)	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Weight of Residuals per day.

300 lbs @ 6.0% total solids; OR 45% moist filter cake

Treatment requirements for residuals Liquid discharge: None; Spent carbon/ waste activated sludge with filter press dewatering to land deposition OR carbon regeneration and sludge destruction with wet air regeneration depending on economics of filter pressing/land deposition.

(a) The total costs expressed in 1-8) above will be about 5.0 to 9.0 cents/gallon processed.

CALGON

CALGON

CALGON CARBON CORPORATION P.O. BOX 717 PITTSBURGH, PA 15230-0717 (412) 787-6700

Writer's Direct Dial Number
412-787-6812

April 30, 1986

Mr. Frank C. Sapienza
Camp Dresser & McKee, Inc.
One Center Plaza
Boston, MA 02108

Dear Mr. Sapienza:

We are pleased to enclose the completed questionnaire on Mobile Treatment Units, and a response to 2 of the 4 scenarios (Pesticide site, and PCB site).

We have not responded to the Leachate site or Heavy Metals site scenarios.

1. Leachate Site - More detail would be needed on the organic species that constitute the total toxic organics, before a judgment as to the applicability of carbon adsorption could be made relative to other technologies.

   At the 2,000 gpd maximum flow, and depending upon the makeup of the total toxic organics, the carbon usage rate could be as low as 10-15# per day. If so, the use of Disposorb units (bulletin enclosed) would probably be the least expensive way to apply adsorption for organic removal in this case.

2. Heavy Metal Site - Liquid phase adsorption would probably not be applicable because of the presence of vinyl chloride which is poorly adsorbed from the liquid phase. Air stripping would remove the vinyl chloride as well as the benzene, although treatment of the air stripper off-gas might be necessary. While we supply air stripping equipment and air stripper off-gas treatment systems on an equipment sale basis, we do not normally supply this equipment on a temporary service basis.

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We want to thank you for including us in your survey, and hope that the enclosed information will be useful to you. If you have any questions, please let us know.

Very truly yours,

CALGON CARBON CORPORATION

Malcolm M Clemens

Malcolm M. Clemens
Director - Environmental Marketing

MMC:cl

CALGON

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - A

Company Calgon Carbon Corporation

Address P.O. Box 717

Town Pittsburgh State Pennsylvania Zip 15230

Contact Person Vince Brunotts Telephone 412-787-6830

1. Treatment processes available in mobile units

Granular Activated Carbon Adsorption

(Mobile units can be combined with carbon exchange service to replace granular activated carbon when necessary).

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-35).

2. Number of mobile units currently available Variable--usually 6-10 units

3. Capacity of each unit: Minimum 2,000# Maximum 40,000#

(Give Units) Minimum Activated Carbon per unit. Maximum Activated Carbon per unit

Minimum ________ Maximum ________

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed). Liquid Wastes Containing Soluble Organic Compounds. Limitations include possibility of prefiltration for hydraulic purposes. Restrictions associated with adsorption involve whether the activated carbon can be returned for reactivation and must be decided on a case-by-case basis (i.e., loading of volatile halides or heavy metals).

#45

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

No chemical process is involved except for physical adsorption on activated carbon.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Removal of most aromatic organic chemicals, chlorinated solvents, and high molecular weight aliphatic compounds can exceed 99.5% depending on rate of carbon usage. Highly soluble organic compounds such as methanol and methyl ethyl ketone are not effectively removed.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)? Removal of organic compounds from wate

Most cost effective for concentrations <1,000 mg/l. Pumpable liquid wi

moderate filterable solids and moderate oil and grease content.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Temperature ambient to 150°F.

Pressure -- up to 75 PSIG.

Residence Time -- Variable depending on specific case.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. Pretreatment ahead of adsorption may include filtration, metals removal, oil removal, air stripping, and pH adjustment

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

The equipment described herein has been used in over 100 separate sites for varying periods of time, and has been commercially available for over 10 years.

11. Describe any other mobile units under construction or development

NONE

12. Market Development

What industry does your mobile treatment technology principally service. Chemical manufacturing industry, potable water industry, emergency response contractors.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site? YES If so, where

Stringfellow site, Los Angeles, CA

Bridgeport Oil, New Jersey

Battle Creek, Michigan

14. Are you presently pursuing Hazardous Waste Site market? YES

15. What are the major impediments to making your mobile technology available for site clean-up work

We see no impediments.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit
48-96 hours depending on transportation time.

17. Additional time required for on-site testing Undefinable

18. Utility requirements (i.e., water, power, steam, wastewater disposal)
Water source (for carbon transfer) approximately 5,000 gallons total.
Air source (for carbon transfer) approximately 100 cfm @ 15 psig.
Motive source for water to be treated.
Transfer Water Disposal: approximately 5,000 gallons.

19. If required utilities are not available at site, can you provide them?
Not normally, but capabilities exist to provide them depending upon overall and most cost effective scope of work.

20. Specify site preparation/space requirements Flat surface, approximately 25 ft. overhead, 15'x25' area accessible for delivery trailer, carbon transfer trailer.

21. Number of personnel required for operation None (for adsorber operation) approximately 2 for carbon transfer operation, others may be needed for monitoring.

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)
Site preparation, transport of waste to treatment unit.

23. What residuals are produced from your mobile unit.

Form of Residual -- Spent activated carbon, typically containing 30% entrained water and up to 15% organic adsorbate.

(soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Solid (GAC)	Adsorbed	Reactivation	None Required,
	Contaminants	or Disposal	Landfill or
	(1-20%) Entrained		Incineration
	Water Approx. 30%		

24. Does residual handling/treatment equipment comprise a significant component (>30%) of on-site equipment and costs? Describe briefly.

No; utilities for carbon transfer only.

25. Specify utility requirements for above

Water: 5,000 gallons total

Air: 100 cfm @ 15 psig.

26. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Water flows 1 - 3,000 gpm with soluble organic compound contamination (within solubility limits).

27. Has your unit(s) ever been permitted by federal, state, or local governments? ______ Yes __X__ No. None permitted by Calgon Carbon Corporation. Several have been permitted by customers.

28. If so, describe type of permit(s) below. Permitting has always been handled by the purchaser.

29. Do you handle permitting of your unit? ______ Yes __X__ No

30. Average time for approval Unknown

31. Information required of client Waste profile, flow rate and delivery pressure, regulatory status (RCRA), presence of TSCA or OSHA regulated compounds, contaminant profile, effluent objectives.

32. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Unknown

General Cost Guidelines

33. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Organic compounds present and concentration, water flow rate, pH, suspended solids, hardness, effluent objectives.

34. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties? Same As Above.

Organic compounds present and concentration, water flow rate, effluent objectives, reactivation potential and regulatory status all effect treatment costs.

Site Scenarios and Cost Analysis

35. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

PESTICIDE SITE - SCENARIO

This scope of work pertains only to the treatment of the groundwater for the removal of organic compounds, i.e., tetrachloroethylene, xylenes, and chlordane. All other site work, including treatment of the groundwater for arsenic removal, if required, is not included in this scope of work.

It is assumed that the organic contaminant levels in the groundwater are as indicated in the scenario, and remain constant over the 5 years, although as a practical matter they would probably drop considerably.

The indicated concentrations are well above the solubility limits. It is assumed that there is a decant tank supplied by others (with disposal of the insoluble phase by others). The adsorption system would follow the decant tank and would see an influent as follows:

Tetrachloroethylene	150 mg/l
Xylenes	3 mg/l
Chlordane	1.8 mg/l

On this basis the carbon usage over the 5 years, at 13.9 gpm average flow is estimated to be 240,000#. Our ability to reactivate the spent carbon will principally depend upon the presence of any TSCA regulated substances (due to possible presence of 2-4-5,T) and the residual arsenic level. If unacceptable for reactivation, disposal will be by others.

The adsorption system proposed will treat 50 gpm maximum at an average flow rate of 13.9 gpm (20,000 gpd).

SCOPE OF WORK

CALGON CARBON

1. Calgon Carbon will provide a single adsorber (10 ft. Ø).
2. Calgon Carbon will supervise the installation.
3. Calgon Carbon will train the operators.
4. Calgon Carbon will provide reactivated carbon for initial fill.
5. Calgon Carbon will provide replacement carbon.
6. Calgon Carbon will reactivate spent carbon contingent on carbon acceptance as discussed previously.

CUSTOMER

1. Railroad ties 18 inch height from grade for temporary foundation.
2. 25-ton crane to set unit.
3. Pipe fitters to install piping.
4. 100 gpm @ 60 psig water to unload carbon.
5. 100 scfm @ 15 psig air to transfer carbon.
6. Drainage for backwash water & truck drainage.
7. Operator for carbon transfers and for day-to-day operation.
8. Decant tank and disposal of insoluble phase.
9. Disposal of spent carbon if unacceptable for reactivation.
10. Routine everyday system maintenance.

CALGON

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide Site

COMPONENT: Activated Carbon Adsorption per Attached Scope for 5 Years

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste/1,000 gal.
1.	Administration	$ 18,000	$0.50
2.	Equipment	$ 95,000[1]	$2.60
3.	Permitting	BY CUSTOMER	
4.	Pre-Operational Testing	$ 5,000	$0.137
5.	Operating Expenses (fuel, treatment additives)	$180,000[2]	$4.93
6.	Mobilization - Demobilization		
	(Local - 100 miles)	$ 42,000	$1.15
	(Non-local - 1000 miles)	$ 48,000	$1.31
7.	Labor (on-site)	BY CUSTOMER[3]	
8.	Laboratory Analyses	BY CUSTOMER	

9. Volume of Residuals per unit volume of waste

240,000# spent carbon (6.6#/1,000 gallons)

Treatment requirements for residuals

Carbon reactivation if acceptable, otherwise disposal by customer.

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[1] Equipment provided on service basis including use of equipment and major maintenance of equipment.

[2] Activated carbon supply.

[3] Estimated to be 1 hour per day plus 3 days per year for carbon transfers.

PCB SITE SCENARIO

This scope of work pertains only to the treatment of the groundwater for the removal of organic compounds, i.e., Benzene, Toluene, TCE.

It is assumed that the organic contaminant levels in the groundwater are as indicated in the scenario, and remain constant over the 5 years, although as a practical matter, they will probably drop considerably so that the estimated carbon usage is probably overstated. Based upon an influent containing Benzene, Toluene and TCE totaling in composite 40 ppm, the carbon usage is estimated to be in the range of 35,000#/yr. at an average flow of 15,000 gpd (10.4 gpm).

It is assumed that the influent could contain a detectable concentration of PCB which would render the spent carbon unacceptable for reactivation, in which case it is assumed that the spent carbon would be disposed of by others.

It is also assumed that the groundwater does not contain significant amounts of oil or suspended solids requiring pretreatment.

SCOPE OF WORK

CALGON CARBON

The Calgon Carbon scope is the same as the Pesticide Scenario except that the spent carbon would probably not be acceptable for reactivation.

CUSTOMER

1. Railroad ties -- 18 inch height from grade.
2. 25-ton crane.
3. Pipe fitters to install piping.
4. Water -- 100 gpm @ 60 psig.
5. Air -- 100 scfm @ 15 psig.
6. Drainage
7. Operator for carbon transfers and for day-to-day operation.
8. Winterization if required.
9. Pumping of groundwater.
10. Disposal of spent carbon assuming it is unacceptable for reactivation.
11. Total cleaning of equipment at the end of project and test documents to verify.

CALGON

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB Site

COMPONENT: Activated Carbon Adsorption per Attached Scope for 5 Years

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste /1,000 Gal.
1.	Administration	$ 18,000	$0.65
2.	Equipment	$ 95,000(1)	$3.47
3.	Permitting	BY CUSTOMER	
4.	Pre-Operational Testing	$ 5,000	$0.18
5.	Operating Expenses (fuel, treatment additives)	$132,000(2)	$4.79
6.	Mobilization - Demobilization		
	(Local - 100 miles)	$ 42,000	$1.53
	(Non-local - 1000 miles)	$ 48,000	$1.75
7.	Labor (on-site)	BY CUSTOMER(3)	
8.	Laboratory Analyses	BY CUSTOMER	

9. Volume of Residuals per unit volume of waste

175,000# (6.4#/1,000 gallons)

Treatment requirements for residuals

Carbon reactivation if acceptable, otherwise disposal by customer.

---

(1) Equipment provided on service basis including use of equipment and major maintenance of equipment.

(2) Activated carbon supply.

(3) Estimated to be 1 hour per day plus 2 days per year for carbon transfers.

CWM

Chemical Waste Management, Inc.
Riverdale Center
150 W. 137th Street
Riverdale, Illinois 60627
312/841-8360

May 28, 1986

Camp Dresser and McKee, Inc.
One Center Plaza
Boston, MA 02108
ATTN: Mr. Arthur L. Quaglieri

Dear Mr. Quaglieri:

We are enclosing completed questionnaires requested by you and by Frank Saprenza concerning Chemical Waste Management mobile equipment.

If you have any questions regarding the data, please feel free to call me.

Regards,

CHEMICAL WASTE MANAGEMENT, INC.

Edward G Fochtman

Edward G. Fochtman
Manager - Customer Programs

EGF:cg

cc: F. Saprenza - w/attachment

Attachment

CWM

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - A

Company Chemical Waste Management, Inc.

Address 150 West 137th Street

Town Riverdale **State** IL **Zip** 60627

Contact Person Dr. Peter Daley **Telephone** (312) 841-8360

1. Treatment processes available in mobile units

Stabilization, oxidation, carbon adsorption, PCB dechlorination.

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-35).

2. Number of mobile units currently available 1

3. Capacity of each unit: Minimum ______ Maximum 100,000 gpd

(Give Units) Minimum ______ Maximum ______

Minimum ______ Maximum ______

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

Used to treat water with chelcated metals. The chelate is oxidized, the metal precipitated and removed by sedimentation/filtration.

Total organic carbon should be below 500 ppm to be economical.

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5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Oxidation with sodium hypochlorite, pH is increased to precipitate metal which is removed as a hydroxide by filtration. Water is discharged to POTW.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

We can remove metals to about 0.1 ppm if required. Some organics are oxidized.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

For dilute aqueous systems with less than 500 ppm TOC.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.)

Most effective reaction temperature is 120°F. Ambient pressure system.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

Complete system.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Commercial at 100,000 gpd

11. Describe any other mobile units under construction or development

—

12. Market Development

What industry does your mobile treatment technology principally service.

Lagoon from metal plating operations.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site? no If so, where

14. Are you presently pursuing Hazardous Waste Site market?

Yes

15. What are the major impediments to making your mobile technology available for site clean-up work

Permit to dispose of treated water.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

90 days

17. Additional time required for on-site testing 20 days

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Treated water disposal

Oil for boiler

About 200 amp at 220 V

19. If required utilities are not available at site, can you provide them?

Yes

20. Specify site preparation/space requirements

Containment for several tanks.

21. Number of personnel required for operation 2/shift

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

None

23. What residuals are produced from your mobile unit.

Form of Residual

(soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Filter Cake	High metal	none	secure
	content		landfill

24. Does residual handling/treatment equipment comprise a significant component (>30%) of on-site equipment and costs? Describe briefly.

No. Residual filter cake to landfill. Need place to dispose of treated water.

25. Specify utility requirements for above

Electrical power and fuel oil.

26. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Lagoons which have recieved chelated metals from plating or from printed circut board manufacture.

27. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ______ No.

28. If so, describe type of permit(s) below. Operating in Kansas under consent decree

29. Do you handle permitting of your unit? X Yes ______ No

30. Average time for approval 9 months

31. Information required of client Analyses to dispose of water in POTW.

32. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Yes. One must examine carefully every aspect of material disposal and the pertinent regulations.

General Cost Guidelines

33. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

34. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties?

Site Scenarios and Cost Analysis

35. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

CWM

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - A

Company Chemical Waste Management, Inc.

Address 150 West 137th Street

Town Riverdale State Il Zip 60627

Contact Person Dr. Peter Daley Telephone (312) 841-8360

1. Treatment processes available in mobile units

Stabilization, carbon adsorption, PCB dechlorination

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-35).

2. Number of mobile units currently available 1-PCB Dechlorination

3. Capacity of each unit: Minimum 4,000 gpd Maximum 10,000 gpd

(Give Units) Minimum Maximum

Minimum Maximum

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

Chemical de-chlorination of PCB and similar chemicals in oils. Concentration limited to 7,500 ppm for most oils. Treated product less than 2 ppm. Trailer mounted. Economics limit water concentration to about 2,000 ppm.

413

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Dechlorination using sodium and propriety solvent blend.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Product has less than 2 ppm PCB

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

Must be oil, water content below 1,000 ppm.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.)

Ambient temperature and pressure. Very low residence time.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

No

4.64

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Commercially available. Has been used to treat hundreds of thousands of gallons.

11. Describe any other mobile units under construction or development

None of this type.

12. Market Development

What industry does your mobile treatment technology principally service. Hydraulic oils as used in many industrial operations, accidential contamination, electric utilities.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site? NO If so, where

14. Are you presently pursuing Hazardous Waste Site market? Yes

15. What are the major impediments to making your mobile technology available for site clean-up work

Permitting; range of acceptable wastes.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

Est. 4 weeks

17. Additional time required for on-site testing 1 week

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Electric power - 100 amp - 220 V

19. If required utilities are not available at site, can you provide them?

20. Specify site preparation/space requirements 50 x 50' -

Need berm

21. Number of personnel required for operation 2/shift

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

--

23. What residuals are produced from your mobile unit. Salt

Form of Residual Water Sludge.

4-66

(soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Sludge	-0-	none	Solid waste landfill
Oil	-0-	supplemental fuel	

24. Does residual handling/treatment equipment comprise a significant component (>30%) of on-site equipment and costs? Describe briefly.

No

25. Specify utility requirements for above

26. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

PCB contaminated oils.

27. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ______ No.

28. If so, describe type of permit(s) below. USEPA-Wash. and Reg. II, IV

29. Do you handle permitting of your unit? X Yes ______ No

30. **Average time for approval** U.S. Approval granted, specific site 2 months.

31. **Information required of client** Amt of oil, PCB or chlorinated content, water content. We test a sample through lab reaction.

32. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Once national permit is granted permitting is not a major problem.

General Cost Guidelines

33. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Waste analysis

34. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties?

Site Scenarios and Cost Analysis

35. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

CWM

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - A

Company Chemical Waste Management, Inc.

Address 150 West 137th Street

Town Riverdale State IL Zip 60627

Contact Person Dr. Peter Daley Telephone (312) 841-8360

1. Treatment processes available in mobile units

Stabilization, oxidation, carbon adsorption, PCB dechlorination.

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-35).

2. Number of mobile units currently available 1

3. Capacity of each unit: Minimum ______ Maximum 100,000 gpd

(Give Units) Minimum ______ Maximum ______

Minimum ______ Maximum ______

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

Used to treat water with chelcated metals. The chelate is oxidized, the metal precipitated and removed by sedimentation/filtration.

Total organic carbon should be below 500 ppm to be economical.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Oxidation with sodium hypochlorite, pH is increased to precipitate metal which is removed as a hydroxide by filtration. Water is discharged to POTW.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

We can remove metals to about 0.1 ppm if required. Some organics are oxidized.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

For dilute aqueous systems with less than 500 ppm TOC.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.)

Most effective reaction temperature is 120°F. Ambient pressure system.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

Complete system.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Commercial at 100,000 gpd

11. Describe any other mobile units under construction or development

—

12. Market Development

What industry does your mobile treatment technology principally service.

Lagoon from metal plating operations.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site? no If so, where

14. Are you presently pursuing Hazardous Waste Site market?

Yes

15. What are the major impediments to making your mobile technology available for site clean-up work

Permit to dispose of treated water.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

90 days

17. Additional time required for on-site testing 20 days

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Treated water disposal

Oil for boiler

About 200 amp at 220 V

19. If required utilities are not available at site, can you provide them?

Yes

20. Specify site preparation/space requirements

Containment for several tanks.

21. Number of personnel required for operation 2/shift

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

None

23. What residuals are produced from your mobile unit.

Form of Residual

(soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Filter Cake	High metal	none	secure
	content		landfill

24. Does residual handling/treatment equipment comprise a significant component (>30%) of on-site equipment and costs? Describe briefly.

No. Residual filter cake to landfill. Need place to dispose of treated water.

25. Specify utility requirements for above

Electrical power and fuel oil.

26. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Lagoons which have recieved chelated metals from plating or from printed circut board manufacture.

27. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ____ No.

28. If so, describe type of permit(s) below. Operating in Kansas under consent decree

29. Do you handle permitting of your unit? X Yes ____ No

30. Average time for approval 9 months

31. Information required of client Analyses to dispose of water in POTW.

32. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Yes. One must examine carefully every aspect of material disposal and the pertinent regulations.

General Cost Guidelines

33. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

34. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties?

Site Scenarios and Cost Analysis

35. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

CWM

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - A

Company Chemical Waste Management, Inc.

Address 150 West 137th Street

Town Riverdale State IL Zip 60627

Contact Person Dr. Peter Daley Telephone (312) 841-8360

1. Treatment processes available in mobile units

Stabilization, carbon adsorption, PCB dechlorination

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-35).

2. Number of mobile units currently available 1-Carbon Adsorption

3. Capacity of each unit: Minimum 125 gpm Maximum 250 gpm

(Give Units) Minimum ______ Maximum ______

Minimum ______ Maximum ______

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

Aqueous wastes with organics which can be adsorbed on activitated carbon. Generally less than 1% organic.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Adsorption

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Effectiveness depends upon chemical composition and adsorption characteristics. Very high for non-polar compounds.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

Aqueous, generally less than 1% non-polar organic contaminant.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.)

Ambient conditions.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

Preceeded by filtration.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Commercially available - in operation.

11. Describe any other mobile units under construction or development

None

12. Market Development

What industry does your mobile treatment technology principally service.

Anyone with lagoons - contaminated surface water.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site? Yes If so, where

Western Processing, Seattle, WA.

14. Are you presently pursuing Hazardous Waste Site market? Yes

15. What are the major impediments to making your mobile technology available for site clean-up work

Dishcarge of clean water must have NPDES or permitted to POTW.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

1-2 weeks

17. Additional time required for on-site testing none

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Self contained. Need place to dispose of treated water.

19. If required utilities are not available at site, can you provide them?

Yes

20. Specify site preparation/space requirements Area 75x75'

21. Number of personnel required for operation One

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

Disposal of clean water.

23. What residuals are produced from your mobile unit.

Form of Residual

(soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Solid	1% organic on carbon	landfill	

24. Does residual handling/treatment equipment comprise a significant component (>30%) of on-site equipment and costs? Describe briefly.

No

25. Specify utility requirements for above ______

26. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Water, 1% organic or less, can be processed at rates up to 250 gpm.

27. Has your unit(s) ever been permitted by federal, state, or local governments? __x__ Yes ______ No.

28. If so, describe type of permit(s) below.

Superfund, State permit for non-hazardous

29. Do you handle permitting of your unit? __X__ Yes ______ No

30. Average time for approval 3 months

31. Information required of client

32. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

It is manageable.

General Cost Guidelines

33. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

34. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties?

Site Scenarios and Cost Analysis

35. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

ENVIROCHEM

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Enviro-Chem Waste Management Services, Inc.

Address 975 Walnut Street - Suite 103

Town Cary State NC Zip 27511

Contact Person Jerry P. Deakle Telephone (919) 469-8490

1. Treatment processes available in mobile units

Acid/Base Neutralization, Phas Separation, Heavy Metal Precipitation,

Oily Emulsion Separation, Carbon Filtration

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available 1

3. Capacity of each unit: (Typically) (Give Units)

Minimum	None	Maximum	4,000 gpd
Minimum		Maximum	
Minimum		Maximum	

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

15% Nitric Acid w/Heavy Metals to 2,000 ppm

15% Sulfuric Acid w/ Heavy Metals to 2,000 ppm

25% Alkaline Waste

Gasoline Type Hydrocarbons to saturation and with free product.

(Information based on system experience)

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

pH Adjustment (H_2SO_4, NaOH)

Organic removal: Phase separation and carbon filtration

Heavy Metals: Oxidative precipitation

Cationic and Anionic Polymer separation and flocculation

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Organics 99.9% by carbon

Heavy metals to <.5 ppm (variable per matrix)

Oil & Grease to <.100 ppm

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

Typically aqueous, pumpable, pilot test required for each batch to determine applicability.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Variable per waste stream- cannot handle concentrated nitric or NF, NO Hydrochloric acid. System not pressure or residence time limited.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. N/A

10. What is status of mobile technology [✓ (1) R&D,] (2) pilot, (3) demo, (4) commercially available 6-8 months, [✓ (5)] commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

System utilized primarily for nitric acid pretreatment for pH

adjustment & heavy metals removal in conjunction with POTW.

Typical cost : $3.00 to $5.00/gallon with 1,000 gal. minimum

11. Describe any mobile units under construction or development

12. Market Development

What industry does your mobile treatment technology principally service?

Electronic, and machine tooling at present

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No ? If so, where

14. Are you presently pursuing hazardous waste site market? Yes

15. What are the major impediments to making your mobile technology available for site clean-up work.

In that one unit is available, only scheduling.

Also, representative samples to qualify system for waste stream.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

1 - 2 weeks

17. Additional time required for on-site testing usually none

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

115/230 single phase, water, POTW or NPDES permit

19. If required utilities are not available at site, can you provide them?

water & power, yes.

20. Specify site preparation/space requirements Must be accessable to 45 foot trailer and road tractor

21. Number of personnel required for operation Usually 3

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

Enviro-Chem was capabilities for all of the above.

23. What residuals are produced from your mobile unit.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
sludge/liquid	Pb, sulfides	Oxidation of	Incineration/
		sulfides	Landfill

24. Specify utility requirements for above Same as #18 unless off-site services requested

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Groundwater remedial services, acid/base neutralization; capacity/ volume always dependent upon waste characteristics.

26. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ____ No.

27. If so, describe type of permit(s) below. POTW discharge permit

28. Do you handle permitting of your unit? x Yes ____ No

29. Average time for approval one week

30. Information required of client sample & compute analysis and any available historical or process data.

31. Has regulatory approval been a significant time factor in the past? No
Please list issues that the client should be aware of

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

100% accountability of waste matric, volume to be treated, location, utilities and POTW/NPDES permit

33. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties? pH & % acid/base concentrations, chelates present or mat. % organic

Site Scenarios and Cost Analysis

34. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

Parameter	Leachate Data Average	High	Pollutant Limitation for Discharge to WWTP (1)
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130 (2)

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(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leechate Site

COMPONENT: Metals/some organics- 4,000 gpd

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	300	.075/gal
2.	Equipment	1200	.30/gal
3.	Permitting	500	.125/gal
4.	Pre-Operational Testing	500	.125/gal
5.	Operating Expenses (fuel, treatment additives)	1500	.375/gal
6.	Mobilization - Demobilization		
	(Local - 100 miles)	500	.125/gal
	(Non-local - 1000 miles)	3200*	.80/gal
7.	Labor (on-site) **	1200	.30/gal
8.	Laboratory Analyses	300	.20/gal

9. Volume of Residuals per unit volume of waste

5% - Based on 2,000

Treatment requirements for residuals Landfill or chemical fixation of sludges.

*Note mileage shall be amortized over ultimate volume treated.

**Perdiem not included.

III

INDUSTRIAL
INNOVATIONS
INC.

May 28, 1986

Mr. Colin W. Baker
Camp Dresser & McKee Inc.
One Center Plaza
Boston, Massachusetts 02108

Dear Mr. Baker:

Enclosed is the following information you have requested by Industrial Innovations. Sorry for the delay in sending out this information, but I hope our package is complete enough for your needs at this time.

1. Survey Questionnaire
2. Brochures on various Cleaning Systems
3. Supermacs Video and Tankcar Video
4. Photo Album of Supermacs & Pond Skipper

Again I appreciate your patience on this request and hope to be hearing from you soon.

Very truly yours,

INDUSTRIAL INNOVATIONS, INC.

Alfred H. Avila
Vice President

AHA/jb

P.O. Box 830 • Stockton, California 95201 • 209/462-8241 • Telex 176264

III

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - A

Company INDUSTRIAL INNOVATIONS INC.

Address 620 South Aurora

Town Stockton State CA Zip 95203

Contact Person William G. Urbani Telephone (209) 462-8241

1. Treatment processes available in mobile units

Remote control collection, liquification, thermal conditioning, chemical conditioning, phase separation, resource recovery, liquifier recycling, trash removal, solids concentration by centrifucation, cake solidification, air emission control all in one coordinated mobile system.

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-35).

2. Number of mobile units currently available 3 complete and different systems

3. Capacity of each unit: (Give Units)

A. Super Macs w/ Phaser 450	Minimum	50 gpm	Maximum	100 gpm
Super Macs w/ Phaser 600	Minimum	100 gpm	Maximum	200 gpm
Phasemaster	Minimum	100 gpm	Maximum	200 gpm

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed). Heavy petroleum (tar) and chemical sludges, mixed with soil and paint residues saturated with organic and chlorinated organic solvents. Sludge contains 10-250 ppm PCBs. Concentration of Phase component varies greatly with location and depth of pond, eg. Water 25-50%, -Solids 20-40%, -Hydrocarbons and Solvents 15-50% by weight.
Limitations to processing are heat loss and variable phase ratios. Efficiency can be enhanced by chemical use.

III

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Our systems are basically physical collection and treatment systems with Ph adjustment and chemical enhancement used to achieve rapid and complete phase separation when necessary.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

The III Phase Series Systems can collect and process any petroleum or chemical sludges producing a water wet cake free from Freon extractable oil, oil phase free from solids with less than 3% water, and a water phase free with emulsified oil below 5000 ppm.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

There are no known specific waste requirements.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Variable fire heat exchanger to 5.7 M BTUs up to boiling point of Liquifier - 20 in. Hg Vacuum - 300 gpm-300 psi power liquification - 20 minutes to several days residence time.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

Our mobile systems are complete and totally self-contained and powered. No pretreatment or post-treatment required.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

(5) - Dedicated service contract cost analysis

Brochure and Film available.

11. Describe any other mobile units under construction or development

Phaser 6-100 - and Phasemaster under construction

12. Market Development

What industry does your mobile treatment technology principally service. Petroleum and chemical industries, Hazardous liquid and solids waste disposal sites, Hazardous waste clean-up sites.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site? Yes If so, where Queen City - Seattle WA

14. Are you presently pursuing Hazardous Waste Site market? Yes

15. What are the major impediments to making your mobile technology available for site clean-up work None other than market awareness of our system's existence and availability.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

One day.

17. Additional time required for on-site testing 2 hours.

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

No utility requirements - The Phaser Systems are totally self-contained and powered and can work anywhere there is waste.

19. If required utilities are not available at site, can you provide them?

Answered above.

20. Specify site preparation/space requirements No special space requirements or site preparation other than access road. The system itself occupies less than 1000 sq. ft. and will operate up to 500 feet from the waste source.

21. Number of personnel required for operation 3 people to operate.

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) The transportation and disposal of the residues are not provided in our system.

23. What residuals are produced from your mobile unit.

Form of Residual

(soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Water	1% or less	Variable w/ Constituency	Sewer
Light Liquid	1% or less	Recycle, Incineration, or Solidification and Landfill	
Heavy Cake	30% or less	None	Landfill
Trash	20% or less	None	Landfill

24. Does residual handling/treatment equipment comprise a significant component (>30%) of on-site equipment and costs? Describe briefly.

It comprises less than 10% of the costs. The Phaser Series Systems are complete and need only the use of portable storage tanks to hold processed liquid phases.

25. Specify utility requirements for above

N/A

26. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

The combination of Hazardous and Toxic oily and chemical sludges found in any type of containment, (500 cu. yds. - 100,000 gallons or more is needed for relocation feasibility.)

27. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ______ No.

28. If so, describe type of permit(s) below. Unknown because permits are supplied by others.

29. Do you handle permitting of your unit? ______ Yes X No

///

30. Average time for approval NA

31. Information required of client NA

32. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Not known

General Cost Guidelines

33. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Weather and Climate regarding heat loss - type of containment - access Quantity, Physical & Chemical characteristics of waste (samples.) Disposal requirements and location, Process time required as per above data.

34. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties? Known equipment-related amortization, operation and maintenance costs as per process time required. Transportati and disposal costs - Chemicals and additives costs - Administrativ down-time.

Site Scenarios and Cost Analysis

35. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

III

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB Site

COMPONENT: Material Extraction and Phase Separation thereof:

Super Macs/Phaser 6-100 with Twin Centrifuges

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	$ 25,000	$ 6.25/cu. yd.
2.	Equipment: Capital amortization, insurance, maintenance, safety and add. equipment	66,400	16.60/cu. yd.
3.	Permitting	------	------
4.	Pre-Operational Testing	7,990	------
5.	Operating Expenses (fuel, treatment additives)	28,280	7.07/cu. yd.
6.	Mobilization - Demobilization		
	(Local - 100 miles)	7,990	------
	(Non-local - 1000 miles)	15,780	------
7.	Labor (on-site)	48,480	12.12/cu. yd.
8.	Laboratory Analyses	7,500	1.87/cu. yd.

9. Volume of Residuals per unit volume of waste

Depending on waste analysis - centrifuged solids/aqueous phase/oils & light phase.

Treatment requirements for residuals Centrifuged solids to landfill -

Aqueous phase to treatment - Oils & light phase to incineration

Job Costs = Process @ 4000 GPH X Time ÷ Total Gallonage = Costs of 199,430/Gal. = 0.24 per Gal./202 = 48.48 per cu. yd.

Material Extraction and Phase Separation Thereof.

Note: The above numbers are based on processing the actual volume of sludge impounded - @ 4000 cu. yd.. In order to include the additional contaminated soils of 20,000 cu. yd., the above job costs of $199,430. would have to be multiplied by the factor of 5.

KII

KIPIN INDUSTRIES, INC.
513 GREEN GARDEN ROAD, ALIQUIPPA, PENNSYLVANIA 15001
412/495-6200

April 22, 1986

Mr. Frank C. Sapienza
Camp Dresser & McKee
One Center Plaza
Boston, Massachusetts
02108

Dear Mr. Sapienza:

With reference to your letter of April 8, 1986, enclosed are completed forms for our basic three procedures.

1) Mobile - Liquid Stripper/Vaporizer
2) Mobile - Waste-to-Fuel Processor
3) Mobile - Solids Roaster/Dryer

We had hoped to have our new brochures which explain most of the process, but these will not be ready for two weeks. We will foreward these as soon as they are available.

Please call if you have any questions or need further clarification or information.

Very Truly Yours,

Pete Kipin

PK/kk
enclosure

SUPERFUND SITE

MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Kipin Industries, Incorporated

Address 513 Green Garden Road

Town Aliquippa State Pennsylvania Zip 15001

Contact Person Peter Kipin, President Telephone (412) 495-6200

1. Treatment processes available in mobile units

Mobile Liquid Stripper/Vaporizer

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34)

2. Number of mobile units currently available One; second unit avail. July, 1987

3. Capacity of each unit: Minimum 5 gpm Maximum 100 gpm

Minimum ____ Maximum ____

Minimum ____ Maximum ____

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCB's, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

Any liquid containing two or more different vapor pressures.

Preceding page blank

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

   Varies with waste stream. Some emulsion breakers, pH control, etc. may be required.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

   99% efficiency on most liquids depending on the mixture. Process has ability for rapid turndown/upturn to meet variables. If required, second pass can be accomodated to further separate multiple fluids.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

   None. Separation of solids, etc. in pretreatment units is available if required to meet conditions.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.)

   Totally variable with the waste stream.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

Again, this is a function of the waste stream. Parameters such as solids, pH, vapor pressure, emulsion, physical storage (tank, lagoon, pit) all affect the equipment needs.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Unit One commercially available in two to four months. Unit Two available in four to six months. Unit One is captive at present. Unit Two is under construction.

11. Describe any mobile units under construction or development.

12. Market Development

What industry does your mobile treatment technology principally service?

Chemical, steel, oil

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No ? If so, where

14. Are you presently pursuing hazardous waste site market? No

15. What are the major impediments to making your mobile technology available for site clean-up work.

Availability. Units generally become captive.

On-site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

Two days after arriving on-site.

17. Additional time required for on-site testing Generally, three to four days are required to establish basic parameters of operation.

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Totally self-sufficient in power, water, steam and air. Water disposal may be required depending on the waste stream.

19. If required utilities are not available at site, can you provide them?

Yes.

20. Specify site preparation/space requirements 50 feet by 100 feet.

21. Number of personnel required for operation 3 men per turn.

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

All are available.

23. What residuals are produced from your mobile unit. Depends on the waste stream.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Diposal

- Soil can be processed on-site in a roaster for on-site or off-site disposal.
- Sludge can be processed on-site for fuel or dryed.
- Liquids can be processed for fuel, sold or shipped as specifications dictate.

24. Specify utility requirements for above

Varies with waste stream. Air 10-100 cfm. Steam - 3000/6000 lb/hr

Water for boiler., Power 30 kw to 100 kw.

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Waste oils, solvents, contaminated water with flash points under 250^{O}F

Volume is 5 gpm to 100 gpm depending on the stream. Sludge separation for processing under alternate units is available.

26. Has your unit(s) ever been permitted by federal, state, or local governments? Yes [✓ No]. (In the process of obtaining precidence in Pennsylvania.)

27. If so, describe type of permit(s) below N/A

28. Do you handle permitting of your unit? N/A Yes No

29. Average time for approval N/A

30. Information required of client Complete analysis, sample (5 gallon) and site visit.

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Prior to accepting work, a review with state agencies is conducted to ensure compliance. Consumers of finished product, if applicable, are given full details of origin and certified specifications.

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Water, sulfur, ash, BTU, solids, chlorides, metals, flash, priority pollutants, PCB.

33. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties?

Site visit, drawings, inconsistency in waste stream which requires continuous monitoring, removal from drums, solids separation, viscosity variations can affect pricing.

KIPIN

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Kipin Industries, Incorporated

Address 513 Green Garden Road

Town Aliquippa State Pennsylvania Zip 15001

Contact Person Peter Kipin, President Telephone (412) 495-6200

1. Treatment processes available in mobile units

Mobil Waste-to-Fuel Processor

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available Six

3. Capacity of each unit: ~~Minimum~~ Range 2 tons per hour to 100 tons per hour

(Give Units) Minimum Maximum

Minimum Maximum

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

Sludges, tank bottoms, solids, etc. which have BTU value for conversion to solid fuel.

Restrictions are PCB's Some limitations on pesticides, etc. Must review analysis and job site to determine all data.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Proprietary process. Final product looks and feels like coal.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

All sludges, oils, etc. are processed into a solid form for shipment to a qualified consumer.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

No restrictions other than having BTU value.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.)

Proprietary.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

N/A

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Commercially available

11. Describe any mobile units under construction or development

More units are constantly being built.

12. Market Development

What industry does your mobile treatment technology principally service?

All industries.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No ? If so, where

14. Are you presently pursuing hazardous waste site market? No

15. What are the major impediments to making your mobile technology available for site clean-up work.

Availability of processing units.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

Two days

17. Additional time required for on-site testing

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Totally self-sufficient

19. If required utilities are not available at site, can you provide them?

yes

20. Specify site preparation/space requirements 50 feet x 100 feet

21. Number of personnel required for operation 3 men per turn

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

All are available.

23. What residuals are produced from your mobile unit. Where applicable. rocks, wood, cans bottles.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal

24. Specify utility requirements for above Varies with the waste stream and site conditions.

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Sludges, tank bottoms, drums. Virtually any site under any condition which contains BTU value.

26. Has your unit(s) ever been permitted by federal, state, or local governments? ______ Yes ______ No. N/A Units have been exempt.

27. If so, describe type of permit(s) below. N/A

28. Do you handle permitting of your unit? ______ Yes ______ No N/A

29. Average time for approval N/A

30. Information required of client Complete analytical data

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of None

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Sulfur, ash, BTU, volatility, moisture, priority pollutants, chlorides, flashpoint.

33. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties? Site visitation and samples. Inconsistency of a lagoon can increase costs.

SUPERFUND SITE

MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Kipin Industries, Incorporated

Address 513 Green Garden Road

Town Aliquippa State Pennsylvania Zip 15001

Contact Person Peter Kipin, President Telephone (412) 495-6200

1. Treatment processes available in mobile units

   Mobil Solids Roaster/Dryer

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34)

2. Number of mobile units currently available One

3. Capacity of each unit: Minimum ______ Maximum 50 tons per hour

   Minimum ______ Maximum ______

   Minimum ______ Maximum ______

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCB's, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

   Contaminated soil. Will volatize all organics with a boiling point under 1000°F.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

N/A

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Organics with boiling points under $1000^{\circ}F$ are removed at efficiency of 99%.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

None.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.)

Varies with waste streams.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

Depends on the waste stream and contaminants.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Commercially available in six months.

11. Describe any mobile units under construction or development.

12. Market Development

What industry does your mobile treatment technology principally service?

All industries.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No ? If so, where

14. Are you presently pursuing hazardous waste site market? No.

15. What are the major impediments to making your mobile technology available for site clean-up work.

Availability

On-site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit

Three days.

17. Additional time required for on-site testing

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Self-sufficient

19. If required utilities are not available at site, can you provide them?

Yes

20. Specify site preparation/space requirements

100 feet x 100 feet

21. Number of personnel required for operation 3 men per turn.

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) ____________

None

23. What residuals are produced from your mobile unit.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Diposal
Dry Solid			Landfill on-site
			or off-site

24. Specify utility requirements for above Self-sufficient

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Soils contaminated with oils, solvents, etc. which have boiling points under 1000°F.

26. Has your unit(s) ever been permitted by federal, state, or local governments? ________ Yes ___X___ No.

27. If so, describe type of permit(s) below N/A

28. Do you handle permitting of your unit? Yes No N/A

29. Average time for approval N/A

30. Information required of client Complete analysis

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

N/A

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Complete analysis and site visitation

33. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties?

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

KIPIN

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

Parameter	Leachate Data		Pollutant Limitation for Discharge to WWTP (1)
	Average	High	
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130 (2)

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(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB Site

COMPONENT: Roaster/Dryer plus Waste-to-Fuel Processor

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration		
2.	Equipment	Insufficient information in scenario to develop costs.	
3.	Permitting		
4.	Pre-Operational Testing		
5.	Operating Expenses (fuel, treatment additives)		
6.	Mobilization - Demobilization		
	(Local - 100 miles)		
	(Non-local - 1000 miles)		
7.	Labor (on-site)		
8.	Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide Site

COMPONENT: Stripper/Vaporizer plus Roaster/Dryer

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration		
2.	Equipment	Insuffucent	information
3.	Permitting	in scenario	to develop
4.	Pre-Operational Testing	costs.	
5.	Operating Expenses (fuel, treatment additives)		
6.	Mobilization - Demobilization		
	(Local - 100 miles)		
	(Non-local - 1000 miles)		
7.	Labor (on-site)		
8.	Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leachate Site

COMPONENT: Stripper/Vaporizer

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	Inc.	
2.	Equipment	$2,000.00/turn	
3.	Permitting	?	
4.	Pre-Operational Testing	?	
5.	Operating Expenses (fuel, treatment additives)	$600.00/turn	
6.	Mobilization - Demobilization (location unknown)		
	(Local - 100 miles)	Cost @ $4.00/running mile plus $4000.00 set-up/knockdown fee	
	(Non-local - 1000 miles)		
7.	Labor (on-site)	Inc.	
8.	Laboratory Analyses	Not known	

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals Depends on what they are. Scenario does not provide sufficient information.

MSR

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - A

Company Mobile Solvent Reclaimers, Inc.

Address R.R. 1

Town St. Joseph State Missouri Zip 64507

Contact Person Larry L. Lambing Telephone 816-232-3972 816-271-4392

1. Treatment processes available in mobile units

   Distillation and reclaiming of industrial solvents.

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-35).

2. Number of mobile units currently available -1-

3. Capacity of each unit: Minimum 100 gals Maximum 500 gal/day

   (Give Units) Minimum ____ Maximum ____

   Minimum ____ Maximum ____

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

   Liquid, industrial solvents containing less than 5% by weight Solute.

4-12-5

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

N.A.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)?

Must be a pumpable liquid, can not contain polyurethanes.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) 40 gals/hour ± 5 gals depending on solvent that is being reclaimed.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. None

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

(5) Commercially available now.

11. Describe any other mobile units under construction or development

None

12. Market Development

What industry does your mobile treatment technology principally service. Small businesses that use solvents for cleaning purposes.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site? NO If so, where

14. Are you presently pursuing Hazardous Waste Site market?

15. What are the major impediments to making your mobile technology available for site clean-up work Limited to pumpable solvents that can be distilled.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit 2-4 weeks

17. Additional time required for on-site testing

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Power

19. If required utilities are not available at site, can you provide them?

Yes

20. Specify site preparation/space requirements Need the possibility of being located at least 100 ft from solvent containers and 50 x 50 ft area to place unit.

21. Number of personnel required for operation -2-

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) We do not provide excavation, waste transportation, or treatment/disposal of residues.

23. What residuals are produced from your mobile unit.

Form of Residual Slug-- still bottoms

(soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal

24. Does residual handling/treatment equipment comprise a significant component (>30%) of on-site equipment and costs? Describe briefly.

25. Specify utility requirements for above

26. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Reclaiming of industrial Solvents... Rate 40 gal/hr ± 5 gals.

27. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ______ No.

28. If so, describe type of permit(s) below. Missouri Department of Natural Resources # RR041

29. Do you handle permitting of your unit? X Yes ______ No

30. Average time for approval

31. Information required of client Chemical analysis of solvent

32. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of No

General Cost Guidelines

33. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

1. Location 2. Volume 3. Chemical composition

34. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties? Large amounts of solute residues, water, and polyurethane residues.

Site Scenarios and Cost Analysis

35. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

REXNORD

Rexnord

Corporate Research &
Innovation Group
EnviroEnergy Technology Center
5103 West Beloit Road
P.O. Box 2022
Milwaukee, WI 53201
414/643- 3054

May 29, 1986

Mr. Frank C. Sapienza
Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108

Dear Mr. Sapienza:

Subject: Superfund Site Mobile Treatment Units Chemical/Physical Process Survey

Enclosed please find our completed survey for our mobile advanced waste treatment system van. Also included is some additional information on other skid-mounted and mobile equipment that Rexnord has available.

We apologize for the delay in submitting this survey, but our project workload forced us to shelve it until time was available to complete it. We do hope that this information can still be included in the program for circulation within the EPA.

Thank you for providing us with the opportunity to submit this information on our mobile equiment. Please do not hesitate to call Dick Osantowski at 414/643-2762 or myself at 414/643-3054 if there are any further questions, concerns or information required.

Sincerely,

Jeffry L Pope

Jeffery L. Pope
Project Engineer

/sy

Enclosure

WILLIAM C. MESSINGER CORPORATE RESEARCH & INNOVATION CENTER

REXNORD

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - A

Company Rexnord Inc. - EnviroEnergy Technology Center

Address 5103 West Beloit Road

Town Milwaukee State Wisconsin Zip 53214

Contact Person Dick Osantowski Telephone 414/643-2762

1. Treatment processes available in mobile units

   Carbon adsorption, Advanced Water Treatment (physical/chemical techniques)
   sludge dewatering, reverse osmosis, sand filtration, ion exchange,
   clarification and microscreening

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-35).

2. Number of mobile units currently available one

3. Capacity of each unit: Minimum 1 gpm Maximum 10 gpm

   (Give Units) Minimum ______ Maximum ______

   Minimum ______ Maximum ______

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

   1. Groundwater contaminated with volatile organics and toxic metals, 0-1500 ppm. Organics must be air strippable or carbon adsorbable.

   2. Industrial wastewater contaminated with volatile organics, heavy metals, cyanides and phenols, 0-1500 ppm, cyanide must be amenable to treatment.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

heavy metal precipitation using alum or ferric chloride or lime or

caustic. alkaline chlorination of cyanide to CO_2 and N_2 using hypochlorit

and caustic

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

1,1,1-trichloroethane - 99.9% removal/chloroform - 91% removal

Toluene - 99.6% removal/1,1-Dichloroethane - 99.7% removal

Trichloroethene - 99.8% removal/1,1-Dichloroethene - 99.9% removal

Carbon tetrachloride - 98.5% removal/heavy metals - 90-95% removal

Methylene chloride - 99.7% removal

Acetone - 91.5% removal with raw conc. below 15 ppm

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)? Pumpable liquid to feed the

mobile system

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) ambient temperature, all tanks atmospheric pressure,

residence time at 10 gpm: aeration tank - 20 min, clarifier - 88 min,

air stripper - 3 min, carbon adsorption columns - 15 min.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Commercially available now

11. Describe any other mobile units under construction or development

12. Market Development

What industry does your mobile treatment technology principally service. No specific industries. Any industry or agency that requires this type of equipment.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site? No If so, where

14. Are you presently pursuing Hazardous Waste Site market? Yes

15. What are the major impediments to making your mobile technology available for site clean-up work Informing the private and public sectors that this mobile technology exists and can be contracted if needed.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit Generally 1-2 weeks depending on location.

17. Additional time required for on-site testing 2 weeks - 6 months

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

potable service water

480-3 phase power, 100 Amp

Sanitary sewer discharge transportation must be provided by others.

19. If required utilities are not available at site, can you provide them?

Yes, we can provide the service water and power if needed, but discharge transporation must be provided by others.

20. Specify site preparation/space requirements Need a 15 ft x 60 ft pad which can hold 56,000 lbs (van operating weight)

21. Number of personnel required for operation 1-2 persons

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) any soil excavation, treatment/disposal of metal sludges and spent activated carbon, transportation of waste to mobile unit if source is more than 100 ft from the mobile unit.

23. What residuals are produced from your mobile unit.

Form of Residual

(soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
sludge	heavy metals 1-10,000 mg/kg	Gravity Thickening	landfilling
spent activated carbon	heavy metals organics 1-500 ppm	N/A	landfilling or reactivation

24. Does residual handling/treatment equipment comprise a significant component (>30%) of on-site equipment and costs? Describe briefly.

Not usually, it may if the heavy metal concentrations are high or if carbon life is very short.

25. Specify utility requirements for above Water pumpage for slurrying carbon, sludge pumpage for removing sludge from clarifier and backwashing of carbon and sand filter.

26. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Groundwater, 10,000 - 1 million gallons, used for remedial cleanup or pilot evaluation.

27. Has your unit(s) ever been permitted by federal, state, or local governments? ______ Yes __X__ No.

28. If so, describe type of permit(s) below.

29. Do you handle permitting of your unit? ______ Yes __X__ No

30. Average time for approval 2-4 weeks

31. Information required of client type of waste, source of waste, amount of waste, average and maximum contaminant levels, sample for treatability tests, required discharge permits (air, water), residuals disposal requirements.

32. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of No

General Cost Guidelines

33. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Volume of waste to be treated, contaminants present, discharge limits, any time constraints on the implementation of the treatment process.

34. What additional information is needed for a detailed cost estimate? What key characteristics maximum significantly elevate treatment costs and difficulties? Bench treatability results from collected sample.

Variable nature of waste stream will elevate treatment costs and difficulties.

Site Scenarios and Cost Analysis

35. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

Parameter	Leachate Data		Pollutant Limitation for Discharge to WWTP (1)
	Average	High	
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130(2)

---

(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leachate Site

COMPONENT: VOA's, Metals, BOD

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	$ 2,000	<1¢/gal
2.	Equipment	$ 3,000	<1¢/gal
3.	Permitting	$ 3,000	<1¢/gal
4.	Pre-Operational Testing	$ 5,000	<1¢/gal
5.	Operating Expenses (fuel, treatment additives)	$20,000	3¢/gal
6.	Mobilization - Demobilization		
	(Local - 100 miles)	$ 2,500	<1¢/gal
	(Non-local - 1000 miles)	$ 7,500	1¢/gal
7.	Labor (on-site)	$30,000	4¢/gal
8.	Laboratory Analyses	$15,000	2¢/gal

9. Volume of Residuals per unit volume of waste

approximately 200 gal/1000 gal

Treatment requirements for residuals Gravity thickening then drumming and disposing. A mobile dewatering van can be used in conjunction for larger projects to cut down costs for disposal.

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide Site

COMPONENT: Groundwater

Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1. Administration	$ 10,000	0.03¢/gal
2. Equipment	$ 20,000	0.06¢/gal
3. Permitting	$ 5,000	0.01¢/gal
4. Pre-Operational Testing	$ 25,000	0.08¢/gal
5. Operating Expenses (fuel, treatment additives)	$ 150,000	0.5¢/gal
6. Mobilization - Demobilization		
(Local - 100 miles)	$ 5,000	0.01¢/gal
(Non-local - 1000 miles)	$ 25,000	0.08¢/gal
7. Labor (on-site)	$1,800,000	6¢/gal
8. Laboratory Analyses	5 $ 50,000	0.15¢/gal

9. Volume of Residuals per unit volume of waste

Unknown

Treatment requirements for residuals ______________________

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB Site

COMPONENT: Volatile Organic Compounds in groundwater

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	$ 10,000	0.04¢/gal
2.	Equipment	$ 20,000	0.08¢/gal
3.	Permitting	$ 5,000	0.02¢/gal
4.	Pre-Operational Testing	$ 30,000	0.12¢/gal
5.	Operating Expenses (fuel, treatment additives)	$ 150,000	0.6¢/gal
6.	Mobilization - Demobilization		
	(Local - 100 miles)	N/A	-
	(Non-local - 1000 miles)	$ 20,000	0.08¢/gal
7.	Labor (on-site)	$2,000,000	9¢/gal
8.	Laboratory Analyses	$ 50,000	0.20¢/gal

9. Volume of Residuals per unit volume of waste

None

Treatment requirements for residuals None

Scenario

Heavy Metals Site

The Heavy Metals Site is approximately 65 acres in size. Much of the site is of open fields and wooded side hills but at the foot of the hills is a manufacturing building complex. For many years various kinds of dyes were produced and dye waste containing large quantities of mercury were pumped from the buildings to lagoons on higher ground. At times the high level lagoons filled and overflowed sending mercury sludges down the side hill to wetlands adjacent the manufacturing buildings. Over the years, other liquid wastes in addition to the sludge overflows were discharged to the wetlands. As a result, the groundwater at the site has become heavily contaminated.

Remediation of the soil at the site requires removal or on-site treatment of the contaminated soil and the sludge filled lagoons. It has been estimated that approximately 35,000 cubic yards of contaminated soils are contained in the wetlands and that the old lagoons contain approximately 75,000 cubic yards of sludge and soil. Analysis of soil samples generally give the following results:

	ug/g Dry Wgt. Basis				
	Hg	Cd	Cr	Pb	pH
Lagoon sludge and soil	210	0.3	60	52	7.2
Wetlands	2,200	1.6	320	210	6.0

Despite a relatively high seasonal ground water table, the mercury has been found to be only moderately mobile as shown by water samples from monitoring wells.

Concern has been expressed about possible release of vaporous mercury as a result of excavation or turning over the contaminated soils, particularly since the nearby industrial buildings are occupied with businesses that are unable to shut down to accommodate the cleanup.

The second phase of the remediation will concentrate on cleanup of the groundwater. Several monitoring wells have been installed and sampled. Typical analyses for on-site wells are shown below. Monitoring wells are typically a total of 50 ft deep, 30 ft into rock. Pumping tests of the wells yielded about 100 gpm with static levels at about 10 ft. Volume to be treated is approximately 20,000 gpd for five years. Contaminants include:

Vinyl chloride	121 ppb
Benzene	50 ppb
Chromium	10 ppm

Elevated levels of iron and manganese are also present.

REXNORD

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Heavy Metals Site

COMPONENT: Contaminated Groundwater (Phase II)

	Primary Costs		Cost for Site	Cost/Unit Volume of Waste
1.	Administration	$	10,000	0.03¢/gal
2.	Equipment	$	25,000	0.08¢/gal
3.	Permitting	$	5,000	0.01¢/gal
4.	Pre-Operational Testing	$	30,000	0.09¢/gal
5.	Operating Expenses (fuel, treatment additives)	$	175,000	0.6¢/gal
6.	Mobilization - Demobilization			
	(Local - 100 miles)	$	7,500	0.02¢/gal
	(Non-local - 1000 miles)	$	20,000	0.07¢/gal
7.	Labor (on-site)	$	1,800,000	6¢/gal
8.	Laboratory Analyses	$	50,000	0.15¢/gal

9. Volume of Residuals per unit volume of waste

approx. 100 gal sludge/1000 gal treated

Treatment requirements for residuals Gravity thickening then dewatering followed by landfilling

TERRA VAC INC.
356 FORTALEZA ST. P.O. BOX 1591, SAN JUAN, PUERTO RICO 00903 ■ TEL (809) 723-9171

June 11, 1986

Collin Baker
CDM
1 Center Plaza
Boston, Mass. 02108

RE: Mobile Treatment Survey

Dear Mr. Baker:

Thank you for your interest in the Terra Vac Recovery Process. Please find enclosed the survey that you sent regarding mobile treatment systems. The Terra Vac Process is an in-situ treatment system to clean up soils contaminated with volatile compounds. In reviewing the four senerios in the survey our process is applicable to the portion of each problem that involves volatiles in soils.

In an effort to provide you with a better understanding of how our process can be applied to various site conditions our approach to each scenerio is summarized below.

Scenerio 1 -- Leachate
Treatment of contaminated groundwater is not directly applicable to the Terra Vac technology.

Scenerio 2 -- Pesticides
Due to the low volatility of most pesticides our process would be directed toward extracting the volatile contaminants in the soils that are a source of the reported PCE and xylene contamination in groundwater. Since the VOC contamination for groundwater is reported in mg/kg at levels far above the solubility limits it can only be assumed that these are concentrations for soils or they are water samples with separate phases. In either case, vacuum extraction of the gross contamination of VOC's would reduce the mobility of the pesticides in soils and groundwater and make for a more cost effective situation to treat the remaining pesticides.

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Scenerio 3 -- PCB

Similar to the Pesticide site the source of the benzene, toluene and TCE in groundwater can be effectively removed by the Terra Vac Process. This would signifcantly reduce the duration of groundwater treatment required at the site and volume of contaminated water to be treated.

Scenerio 4 -- Metals

Since mercury is the biggest problem at the site and its volatility will hinder other cleanup measures, the Terra Vac Process would be effective in extracting the mercury from the soils before other treatment processes are implemented. With the vacuum process the mercury can be controlled completely in a non-dispersive manner so as not to affect the other operations near the site. For the contaminated wetlands the vacuum system can be used for "2-phase" recovery of mercury: extraction of the dissolved components in the groundwater and as the wetlands are dewatered the adsorbed mercury would be recovered with the same vacuum recovery system. Vapor and aqueous phases would then be separated and treated independently.

For the site specific cost information that was requested please refer to the case history enclosed entitled "Vacuum, Defense System for VOC Contamination" for which the following cost information is provided.

Pilot testing: (3 months on about 1300 cubic yards)	
Engineering	$ 21,000
Field installation and equipment....	48,000
Chemical analysis..................	34,800
Administration (roughly 25%)........	26,000
Subtotal	129,800
Full Scale Treatment (roughly 7 million cubic yards of soil)	
Engineering	57,600
Field installation and equipment..........	126,000
Monitoring...............................	280,000
Permitting	26,400
Operating Costs (electricity & maintenance)	186,000
Administration (roughly 15%)..............	101,000
Subtotal	777,000
Total Cleanup Cost (estimating remaining projected costs)	$ 906,800

Additional comparative cost information is also included in

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the enclosed paper entitled "Low Cost, Site Specific..." Other papers including a project listing is enclosed for your information. If you have any questions regarding our process or have specific sites with VOC contamination in soils, please contact us.

Very truly yours,

TERRA VAC, Inc.

James J. Malot, P.E.
President

TERRA VAC

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Terra Vac Inc.

Address P. O. Box 1591

Town San Juan State Puerto Rico Zip 00903

Contact Person Jim Malot Telephone (809) 723-9171

1. Treatment processes available in mobile units

Vacuum Extraction Process to remove volatile contaminants from soils and groundwater, an in-situ treatment process

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available 6

3. Capacity of each unit: Minimum 80,000 Maximum 400,000

(Give Units) Minimum 10,000 Maximum 28,000

Treatment capacity in cubic feet of soil Minimum 35,000 Maximum 100,000

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

Treats in place soils to any depth; applicable to all contaminants that have a volatile character; full range of concentration - saturated to non-detectable; any soil type and any depth; cost effectiveness increases with increasing depth to water table; metals and heavy organics not removed; effective for contaminated "perched" groundwater; removes liquid hydrocarbons floating on groundwater ; removes liquid hydrocarbons floating on groundwater table without pumping groundwater.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

The process is more of a physical type inducing in-situ volatilization and vapor recovery.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

More than 99% removal for carbon tetrachloride, hexane, benzene, toluene, xylenes, tetrachloroethene, similar recovery/removal efficiencies for ketones, alcohols, and others. However, process will not take longer for highly soluble, non volatile compounds.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)? Depth to groundwater more than 5 ft., drilling in contaminated area with manageable risks

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Vacuum, flow rate, moisture content

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. None. Possible post-treatment for vapor recovery/control.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

Commercially available now. Refer to project list, cast and performance evaluations in attached articles, contact Jim Malot.

11. Describe any mobile units under construction or development

Six additional units with greater versatility are under construction and development.

12. Market Development

What industry does your mobile treatment technology principally service?

Chemical, petroleum, gas stations, pharmaceutical

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site Yes ? If so, where Barcezoneta, Puerto Rico

14. Are you presently pursuing hazardous waste site market? Yes

EPA sites program and other contacts

15. What are the major impediments to making your mobile technology available for site clean-up work. Bureaucratic; reluctance of consultants to recommend anything innovative, lack of exposure to decision makers.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit One day to couple months depending on site conditions

17. Additional time required for on-site testing One to three weeks

18. Utility requirements (i.e., water, power, steam, wastewater disposal)
Power

19. If required utilities are not available at site, can you provide them?
Yes

20. Specify site preparation/space requirements Drulling of wells or extraction trenches.

21. Number of personnel required for operation 2 to 5

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

Excavation/drilling, although supervision provided, carbon if vapor recovery system used.

23. What residuals are produced from your mobile unit. Usually none, (vapors vented) May have liquids, carbon, and or wastewater in some cases

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Soil	No	None	Leave in place
Liquid	Separate phase	Recycle	Reuse
Vapors	ND to 10 mg/l	Adsorption combustion condensation	Vented

24. Specify utility requirements for above Power, Water

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Volatiles, deep groundwater

26. Has your unit(s) ever been permitted by federal, state, or local governments? __X__ Yes _____ No.

27. If so, describe type of permit(s) below. Use permit by local agencies

28. Do you handle permitting of your unit? X Yes ______ No
usually

29. Average time for approval ______

30. Information required of client 90 days to retroactive

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of Soil type, contaminants present in soils, hydrogeological setting

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)
Emissions are a touchy subject of the site more rigorous testing and equipment mobilization will be required. We can get it out of the ground easier than what it takes to produce zero air emissions.

33. What additional information is needed for a detailed cost estimate? What key characteristics may significantly elevate treatment costs and difficulties?
Subsurface profiles: soils, stratigraphy, contaminants, depth to water table, surface or subsurface obstructions.

Site Scenarios and Cost Analysis

34. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)
Total mass of contaminants, c leanup criteria (How clean is clean), limintations on air emissions.

TETRA RECOVERY SYSTEMS
Formerly a DRAVO Division

May 28, 1986

Mr. Frank C. Sapienza
Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108

Dear Mr. Sapienza:

Enclosed are five forms covering Tetra Recovery Systems mobile processing equipment. The equipment covered is as follows:

1. Liquid/Solid Separation - Lectro Clear System
2. Dewatering System - Belt Filter Press
3. Dewatering System - Filter Press
4. Filtration System - Filter Press
5. Oil Recovery - Centrifuge

Because of lack of time the forms were filled out by hand and question #34 was not addressed. I hope that they will give us some information about our capabilities, and if you have any questions feel free to call me.

Very truly yours,

Ogden A. Clemens

Ogden A. Clemens
Operations Manager
Tetra Recovery Systems

OAC/jb

Attachment

A Division of TETRA RESOURCES, INC.

SAINTE CLAIRE PLAZA. 1121 BOYCE RD., SUITE 1300. PITTSBURGH, PENNSYLVANIA 15241 • (412) 941-2[illegible]

4117

TETRA

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Tetra Recovery Systems

Address 1121 Boyce Road, Suite 1300

Town Pittsburgh State PA Zip 15241

Contact Person O. A. Clemens Telephone 412/941-2660

1. Treatment processes available in mobile units

   a Wastewater Treatment-Lectro Clear System
   b Sludge Dewatering System - Belt Filter Press System
   c Sludge Dewatering System - Filter Press
   d Oil Recovery - Centrifuge
   e Filtration Systems - Filter Press

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available 1 Oil Recovery Centrifuge

3. Capacity of each unit: Minimum ______ Maximum 100 gpm

   (Give Units) Minimum ______ Maximum ______

   Minimum ______ Maximum ______

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed). Oily Waste - over 20% oil - Petrochemical Refinery Pit - slop oil, API bottoms, drilling muds, producer water etc.

   Oil Recovery is main objective and disposal of water and solids secondary.

   Centrifuge followed by belt filter dewatering system.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Heat, cationic and anionic polymer addition and at time acidulation - lower of pH.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Recovery of oils - dewatering solids to 50-60% solids.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)? Pumpable liquid with 20% or more oils.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Heat to 180 °F, residence time depends on characteristics of oily sludge.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. Heat and pH control prior to centrifuging, followed by dewatering by belt filter press system.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

(3) Purchase equipment from France.

11. Describe any mobile units under construction or development

Operating in West Europe for last two years.

12. Market Development

What industry does your mobile treatment technology principally service?

Petrochemical

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No ? If so, where

14. Are you presently pursuing hazardous waste site market? Yes

15. What are the major impediments to making your mobile technology available for site clean-up work. Purchase and transport to U.S.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit Depends on availability of equipment, and location of job. One day required for rigup on site.

17. Additional time required for on-site testing Test before on site mob.

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Filtrate and Press Cake disposal required.

19. If required utilities are not available at site, can you provide them?

Yes

20. Specify site preparation/space requirements 75' x 100'

21. Number of personnel required for operation 3

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) Can provide all service through subcontract.

23. What residuals are produced from your mobile unit.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Oil	99.6%	none	sell
Press Cake	50% solid	stabilization incineration	landfill
Filtrate	Less 50 ppm TSS	wastewater treatment	to wastewater plant

24. Specify utility requirements for above None

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Refinery sites with waste oil pits and lagoons.

26. Has your unit(s) ever been permitted by federal, state, or local governments? ______ Yes __X__ No.

27. If so, describe type of permit(s) below. - - - - -

28. Do you handle permitting of your unit? - - - Yes ______ No

29. Average time for approval - - - - -

30. Information required of client - - - - -

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of - - - - -

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Sample of sludge, volume to be processed, method of disposal of press cake and filtrate.

33. What additional information is needed for a detailed cost estimate? What key characteristics may significantly elevate treatment costs and difficulties? From treatability studies - operating capacity of equipment, chemical requirements, % solids in press cake, amount of oil received, and quality of filtrate.

Site Scenarios and Cost Analysis

34. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Don't have time to complete.

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Tetra Recovery Systems

Address 1121 Boyce Road, Suite 1300

Town Pittsburgh State PA Zip 15241

Contact Person O. A. Clemens Telephone 412/941-2660

1. Treatment processes available in mobile units

   (a) Wastewater Treatment System - Lectro Clear
   (b) Sludge Dewatering System - Belt Filter Press System
   (c) Sludge Dewatering System - Filter Press
   (d) Oil Recovery - Centrifuge System
   (e) Filtration System - Filter Press

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available 3 Filtration Filter Press

3. Capacity of each unit: Minimum ______ Maximum 2 cu yd
   (Give Units) Minimum ______ Maximum 2 cu yd
   Minimum ______ Maximum 2 cu yd

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed). Removal of solids from brimes (completion fluids in drilling oil wells). Solids of less than 1000 ppm TSS.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

DE is added as body feed and cationic or anionic polymer may be added.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Removal of solid to less 2 ppm TSS.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)? Pumpable liquid with less than 1000 ppm TSS.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Liquid temperature can be 150 °F but normally is ambient. Atmo. pressure - 100 psi dewatering pressure.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. DE addition system and polymer systems.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

(5) Have been operating two years.

11. Describe any mobile units under construction or development - - - - -

12. Market Development

What industry does your mobile treatment technology principally service?

Oil and gas drilling industry.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No ? If so, where

14. Are you presently pursuing hazardous waste site market? Yes.

15. What are the major impediments to making your mobile technology available for site clean-up work. A contract.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit Availability of the equipment - 1 day for set-up on site.

17. Additional time required for on-site testing None.

18. Utility requirements (i.e., water, power, steam, wastewater disposal) Electric power 460u, 30, 100 KVA.

19. If required utilities are not available at site, can you provide them? No.

20. Specify site preparation/space requirements 50' x 50'.

21. Number of personnel required for operation 1.

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) Can provide disposal of press cake services.

23. What residuals are produced from your mobile unit.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Clean brime	less 2 ppm TSS	None	Reuse
Press Cake	50% Solids	None	Disposal in Landfill

24. Specify utility requirements for above Electric power 460u, 30, 100 KVA.

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Final filtration of low solid liquid.

26. Has your unit(s) ever been permitted by federal, state, or local governments? ______ Yes __X__ No.

27. If so, describe type of permit(s) below. - - - - -

28. Do you handle permitting of your unit? - - - Yes ______ No

29. Average time for approval - - - - -

30. Information required of client - - - - -

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of - - - - -

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Volume, solids content, location of job.

33. What additional information is needed for a detailed cost estimate? What key characteristics may significantly elevate treatment costs and difficulties? None.

Site Scenarios and Cost Analysis

34. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Don't have time to finish.

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Tetra Recovery Systems

Address 1121 Boyce Road, Suite 1300

Town Pittsburgh State PA Zip 15241

Contact Person O. A. Clemens Telephone 412/941-2660

1. Treatment processes available in mobile units

   (a) Wastewater Treatment - Lectro Clear System
   (b) Sludge Dewatering Systems - Belt Filter Press System
   (c) Sludge Dewatering System - Filter Press
   (d) Oil Recovery - Centrifuge System
   (e) Filtration System - Filter Press

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available 2 Sludge dewatering filter press

3. Capacity of each unit: Minimum ______ Maximum 2 cu yds
   (Give Units) Minimum ______ Maximum 2 cu yds
   Minimum ______ Maximum ______

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

   (a) Plan to handle sludge of less than 5% solids, or where drier press cakes are required and oily wastes for oil recovery and dewatering.

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5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

   Plan to use both cationic and anionic polymers.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

   Normally will reduce volumes 80 - 85%.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)? Pumpable liquid 2 - 5% solids.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Temperature 50 - 150 °F, pressure 225 psi, residence time depends on sludge characteristics.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. Chemical feed system pond evacuation system, DE feed system.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

(4) 1 - 2 month

11. Describe any mobile units under construction or development Converting 2 filtration unit to dewatering units.

12. Market Development

What industry does your mobile treatment technology principally service?

Refinery - Petrochemical.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No. ? If so, where

14. Are you presently pursuing hazardous waste site market? Yes.

15. What are the major impediments to making your mobile technology available for site clean-up work. Modification of the equipment.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit Depends on availability of equipment and location of job - 1 day required for

17. Additional time required for on-site testing Testing before on site mobilization.

18. Utility requirements (i.e., water, power, steam, wastewater disposal) Filtrate and press cake disposal required.

19. If required utilities are not available at site, can you provide them? Yes.

20. Specify site preparation/space requirements 75' x 75'.

21. Number of personnel required for operation 2.

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) Can provide through subcontractor.

23. What residuals are produced from your mobile unit.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Press Cake	Depending on sludge 25 - 80% solids	None	Landfill or on-site
If Necessary:			

Press cake could be stabilized with Portland Cement, fly ash, or incinerated. Filtrate could be treated.

24. Specify utility requirements for above None.

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Most sludges can be treated, volume 100,000 gallons or more, 2 - 5% solids.

26. Has your unit(s) ever been permitted by federal, state, or local governments? ______ Yes X No.

27. If so, describe type of permit(s) below. - - - - -

28. Do you handle permitting of your unit? - - - Yes ______ No

29. Average time for approval - - - - -

30. Information required of client - - - - -

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of - - - - -

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Samples of sludge, volume to be processed, method of disposal of press cake and filtrate.

33. What additional information is needed for a detailed cost estimate? What key characteristics may significantly elevate treatment costs and difficulties? From treatability study - operating capacity of equipment, chemical requirements, % solid in press cake and quality of filtrate.

Site Scenarios and Cost Analysis

34. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Don't have time.

TETRA

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Tetra Recovery Systems

Address 1121 Boyce Road, Suite 1300

Town Pittsburgh State PA Zip 15241

Contact Person O. A. Clemens Telephone 412/941-2660

1. Treatment processes available in mobile units

   (a) Wastewater Treatment - Lectro-Clear Trailer

   (b) Sludge Dewatering System - Belt Filter Press
   (c) Sludge Dewatering - Filter Press
   (d) Oil Recovery - Centrifuge
   (e) Filtration System - Filter Press

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available 2-Lectro-Clear Trailers

3. Capacity of each unit: Minimum 100 gpm Maximum 150 gpm

   (Give Units) Minimum 100 gpm Maximum 150 gpm

   Minimum ______ Maximum ______

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed).

   (a) Leachates, plating rinses, acid mine drainage, etc. (heavy metals in acid) - Concentration 1% solids

   (b) Filtrates, Centriates, top water from drilling reserve pits both oil base and water based muds - Cont. - 1% solids.

   (c) Oily Wastes - Cont 3-4% solids.

   (d) Food plant wastewater, tannery, laundry, paper and pulp, etc - Cont. 1% solids.

   Can remove insolubles to very low levels.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Classic Wastewater Treatment - Trivalent Metal Coaqulant (Alum, Ferry, Floc etc.), alkaline pH adjust, and polymer to flocculate - also continuous acidulation (H_2SO_4), reduction hexchrome to tri, cyanide destruct.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Removal of insoluble - 99%.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)? Usually can process liquids with -1% solids but oily wastes -2-3%.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Have units operating at 11,000 ft. 32°F - 180°F water, use 15 min resident time.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. Floating pump - to reactor tank (for hexchrome and cyanide wastewater) - or to trailer for other wastewaters.

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

(5) - Have operated four years.

11. Describe any mobile units under construction or development

- - - - -

12. Market Development

What industry does your mobile treatment technology principally service?

Drilling Mud Reserve Pits
Plating Wastes
Oily Waste (tank cleaning, barge and ballast wastewater)
Filtrate for Belt Filter Press and Centrate

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site Yes ? If so, where String fellow, have treated stringfellow leachate.

14. Are you presently pursuing hazardous waste site market? Yes.

15. What are the major impediments to making your mobile technology available for site clean-up work. A contract!

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit Depends on availability of equipt and location - requires one day (max) for set up on-site.

17. Additional time required for on-site testing Usually test before on-site mob.

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

Have ability to generate water and power req. but prefer water for polymer mix. - Need to dispose of effluent - normally go to POTW, river or irrigation ditch.

19. If required utilities are not available at site, can you provide them?

Yes.

20. Specify site preparation/space requirements 50' x 50'

21. Number of personnel required for operation 2

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) Can provide these but contracting (subcontracting).

23. What residuals are produced from your mobile unit.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Skimming	10-12%	Filtration or Carbon Column (only occasionally)	POTW, River Irrigation Ditch

24. Specify utility requirements for above Power 460v, 30, 100KVA but we normally supply.

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Any wastewater with insoluble solids. Have processed hazardous wastewaters for six months at the BKK Landfill in West Covina, CA.

26. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ____ No.

27. If so, describe type of permit(s) below. Permitted in LA, OK, & TX for drilling mud. Was permitted in CA for plating sludge filtrates from Belt Filter Press.

28. Do you handle permitting of your unit? ______ Yes X No

29. Average time for approval 2 - 3 months.

30. Information required of client Basically, Part A & B of RCRA (most does not apply.)

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of No.

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Sample of waste, volume to be processed, method of disposal.

33. What additional information is needed for a detailed cost estimate? What key characteristics may significantly elevate treatment costs and difficulties? Sample of waste, volume to be processed, method of disposal.

Site Scenarios and Cost Analysis

34. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Don't have time.

TETRA

SUPERFUND SITE
MOBILE TREATMENT UNITS
CHEMICAL/PHYSICAL PROCESSES SURVEY - B

Company Tetra Recovery Systems

Address 1121 Boyce Road, Suite 1300

Town Pittsburgh State PA Zip 15241

Contact Person O. A. Clemens Telephone 412/941-2660

1. Treatment processes available in mobile units

   (a) Wastewater Treatment - Lectro-Clear Trailers
   (b) Sludge Dewatering Systems - Belt Filter Presses
   (c) Sludge Dewatering Systems - Filter Press
   (d) Oil Recovery Systems - Centrifuges
   (e) Filtration Systems - Filter Press

FOR EACH TYPE OF MOBILE TREATMENT UNIT, PLEASE FILL OUT A SEPARATE SURVEY FORM (I.E. QUESTIONS 2-34).

2. Number of mobile units currently available 4 Belt Filter Press Dewatering Systems

3. Capacity of each unit: Minimum ______ Maximum 1200 gpm - 2 meter

   (Give Units) Minimum ______ Maximum 1200 gpm - 2 meter
   1200 gpm - 2 meter
   Minimum ______ Maximum 50 gpm - (1 meter)

4. Describe below: waste types handled, form of waste, concentration range, restrictions or limitations (e.g., soil contaminated with volatile organics and PCBs, 1-1000 ppm, organics must be extractable with water/2% surfactant, metals not removed). All sort of sludges and skimming 2 - 10% cont.

   (a) (Heavy Metal in acid) Acidmine drainage, plating leachate sludges

   (b) Oil and Water Based Drilling Muds 5 - 20% conc.

   (c) Oily waste, API bottom, barge cleaning etc. 5 - 10%.

   (d) Coal Prep. Plant Refuse 20-30%.

   (e) Utilities - bottom ash and fly ash dewatering 20 - 30%.

   (f) Paper and pump - 5 - 10% conc.

   (g) Cooling Tower sludge - 5% conc.

5. If your mobile treatment units utilize a chemical process, what is (are) the basic chemical reaction(s) involved. What chemical reagents are used and what are the process end products (e.g., alkaline chlorination of cyanide to CO_2 and N_2 using chlorine and caustic).

Normally a cationic plus anionic polymer are used to coagulate and flocculate the sludge. Sometimes another chemical is required - sulphuric acid, lime or a trivalent metal coagulant.

6. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Can you provide any such data (e.g., air stripping of contaminated groudwater - 99% removal of trichloroethylene, 60% removal of methyl ethyl ketone, <10% removal of phenols)?

Normally will reduce volume by 75 - 80%.

7. What specific waste requirements must be met for effective utilization of the company's mobile unit(s) (e.g., pumpable liquid with organic concentration 20-300 grams/liter)? For dewatering 5 - 25% solid are required, at lesser amounts a thickener is needed and higher amounts dilution is required.

8. What are system operating parameters (i.e., temperature, pressure, residence time etc.) Temp - 35 - 150 °F, conveyor speed will set residence time - depends on sludge characteristics and % solids.

9. If mobile unit is part of a treatment train, state processes which are likely to be used prior to your mobile unit. Evacuation of pit or lagoon with proper mixing and transfer pumping, mixed holding tanks, clarifier for filtrate, spray water systems

10. What is status of mobile technology (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for follow-up.

(5) Have been in use for 4-5 years.

11. Describe any mobile units under construction or development

- - - - -

12. Market Development

What industry does your mobile treatment technology principally service?

Drilling muds, power plants, refinery, clearing operations, pulp and papers.

13. Has your mobile unit ever been used on an EPA (Superfund) Hazardous Waste Site No. ? If so, where

14. Are you presently pursuing hazardous waste site market? Yes.

15. What are the major impediments to making your mobile technology available for site clean-up work. A contract.

On-Site Utilization - Mobilization Requirements

16. Time required from authorization to start-up of mobile unit Depends on availability of equipment and location of job - 2 days required for

17. Additional time required for on-site testing Test before on site mobilization.

18. Utility requirements (i.e., water, power, steam, wastewater disposal)

None, except filtrate and press cake disposal. Water 50 gpm, electrical power 460V, 30, 100KVA.

19. If required utilities are not available at site, can you provide them?

Yes

20. Specify site preparation/space requirements 75' - 100'.

21. Number of personnel required for operation 2

22. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) Can provide these services but by subcontracting the work.

23. What residuals are produced from your mobile unit.

Form of Residual (soil, solid, liquid, sludge)	Remaining Contams. & Approx. Concen.	Type of Further Treatment Req.	Final Method of Disposal
Press Cake Plating	30% Solids	None	Landfill or on-site
Coal Proper	75% Solids	None	On-Site
Drill Mud	65% Solids	None	On-Site
Municipal	25% Solids	None	Landfill or on-site

Filtrate is usually less 50 ppm TSS and can be treated if necessary.

24. Specify utility requirements for above None.

25. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (e.g., waste type, volume, medium) is your mobile treatment unit best suited for?

Most sludge, 1 MM gal of sludge, best suited in area of 10-15% solids, less than 20% oil, need 2 week work to be economical

26. Has your unit(s) ever been permitted by federal, state, or local governments? __X__ Yes ______ No.

27. If so, describe type of permit(s) below. Permitted in CA for plating sludge.

28. Do you handle permitting of your unit? ______ Yes X No

29. Average time for approval 2 - 3 months.

30. Information required of client Basically Part A & B of RCRA

31. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of No.

General Cost Guidelines

32. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value, etc.)

Sample of sludge, volume to be processed, method of disposal.

33. What additional information is needed for a detailed cost estimate? What key characteristics may significantly elevate treatment costs and difficulties? Volume to be processed, distant for mobilization operating capability on waste processed % solid of press cake and quality of filtrate.

Site Scenarios and Cost Analysis

34. The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms at the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Don't have time.

SECTION 5
COMPANIES OFFERING IMMOBILIZATION PROCESSES

This section presents an inventory of some companies that offer mobile immobilization treatment systems. Only those companies that provided detailed information are included in this section. Immobilization processes are described by such terms as stabilization, solidification, and fixation. The end result of all these processes is to retard migration of contaminants. The key factors to be considered in making a decision to use immobilization processes are:

- Required structural integrity and leaching potential of the resulting solidified mass,
- Volume to be solidified, and
- Final method of disposal.

The vast majority of mobile immobilization systems use cement or pozzolan (lime) as a fixative. The techniques of cement mixing and handling are well-developed and the process is reasonably tolerant of chemical variations in sludge. Elevated levels of organics can interfere with the fixative. Hence, the fixing capability of the cement or pozzolan is often enhanced with additives, permitting immobilization of wastes containing up to 50% organics.

Cost of immobilization varies widely according to the strength and character of the waste material and the volume to be treated. Guidelines to treatment costs are reported in the following table (Table 5.1). A generalized estimate for cost of treatment is not practical due to variation in site and waste characteristics. The final disposal method will significantly influence costs. Bulk of the original material may be increased by 100 to 250 percent when Portland cement or pozzolan (lime) is used. Cost of transport and disposal in a landfill would increase accordingly.

A variety of marketing preferences and methods of operation are presented in the following pages. Some firms employ a mobile technology for immobilization of wastes using a container system; others specialize in continuous or batch operations involving larger waste streams; and still others concentrate their efforts on in-situ immobilization of lagooned wastes. The additives used in immobilization processes are generally upspecified because often this information is considered proprietary.

TABLE 5-1

COMPANIES OFFERING

MOBILE IMMOBILIZATION PROCESSES

Company	Type of Mobil Equipment	Processing Rate	In Situ Capability	Types of Wastes Preferred	Fixation Agent	Time to Mobilize	Guideline Cost of Treatment	End Product
Chemfix Technologies, Inc. Kenner, LA	Mixer, materials handling equip., excavations	50 to 800 gpm	No	Aqueous, <60% solids	Proprietary	2 weeks	$20 to $50/ton	A friable clay-like product
Chemical Waste Management Riverdale, IL	Conventional heavy equipment, mixers, materials handling equipment	Varies	No	Solids, sludges, liquids	Varies	2 days	- - - - -	Unstated
Envirite Field Services Plymouth Meeting, PA	Proprietary dewatering and chemical injection equipment	25,000 to 90,000 gpd	Yes	Solids, sludges, liquids	Unspecified	< 1 day	$0.10 to $0.25/gal	Stabilized landfillable material
Hazcon Inc. Katy, TX	Proprietary mixing, dredging and conveyor equipment	5 to 60 cy/hr.	No	Organics up to 100 % oily sludges, metals	Cement and proprietary agents	12 hours	$65 to $150/cy	Solid, 1,000 - 5,000 psi compr. strength, permeability 10^{-7},
Solidtek Morrow, GA	Proprietary special purpose machinery	5 to 200 cy/hr.	No	No restrictions	Unspecified	3-20 days	- - - - -	Varies according to specifications and method of ultimate disposal
Velsicol Chemical Corp. Memphis, TN	Mixers, excavators, bulldozers	Varies	Yes	Organics up to 45%, sludges	Cement and unspecified chemicals	3-4 weeks	$0.15 to $0.50/gal	Stabilized, heavy clay like substance
Westinghouse Hittman Nuclear Columbia, MD	Proprietary compacting, mixing, and silo equipment	Batch: 150 to 300 gph Continuous: 5 to 15 gpm	No	Liquids, semi-solids	Cement	1-2 weeks	$1350 - $2200/cy*	Solidified mass with high structural integrity
ATW/Caldweld Santa Fe Springs, CA	Custom augering, mixing and injection equipment with full in situ monitoring systems	100-150 cy/hr.	Yes	Solids and soils	Fixation oxidation, precipitation, and biological agents may be injected	1-2 weeks	- - - - -	Stabilized or solidified mass in subsurface

* Stated costs of treatment is for radioactive wastes. No costs quoted for hazardous waste.

CHEMFIX

Chemfix Technologies, Inc.
1675 Airline Hwy. — P.O. Box 1572
Kenner, La. 70063
(504) 467-2800

April 17, 1986

Mr. Arthur L. Quaglieri, P.E.
Camp Dresser & McKee Inc.
One Center Plaza
Boston, Massachusetts 02108

Re: April 7, 1986 Correspondence

Dear Mr. Quaglieri:

Please find enclosed a copy of your April 7, 1986 correspondence regarding Camp Dresser & McKee Inc.'s (CDM) survey on mobile treatment technologies. To simplify Chemfix Technologies, Inc.'s (CTI) response to this survey, I have answered the twenty-six questions within the text of this letter. CTI's response to each question will be itemized below in the order specified within CDM's four-page "Mobile Treatment Units - Fixation/Solidification Survey."

1. Yes. Equipment varies from simple mixing apparatus for low solids wastes (5-30%) to patented mixing and materials handling equipment for high solids wastes and soils (30-60%).

2. Dredges, submersible pumps, standard centrifugal pumps, earth dozers, draglines, etc.

3. The CHEMFIX® process is a series of chemical reactions (i.e., hydration, etc.) that operate above freezing temperatures for water. The CHEMFIX® process is also closed-loop and not normally operated in situ due to quality assurance limitations of in situ techniques. Stabilization can basically be achieved for any waste that is aqueous based and below 60% solids.

4. See Attachment A.

5. A total of four mobile units incorporating two separate designed models.

6. Design Model 1: Minimum = 50 gpm
   Maximum = 400 gpm

   Design Model 2: Minimum = 50 gpm
   Maximum = 800 gpm

7. All mobile units mentioned above are commercially available and research and development projects and designs are proprietary.

8. Five commercially available now (see Attachments A, B, and C).

9. Geographically/continental U.S. Waste type and generation - medium to large volumes for waste impoundments and contaminated soil at generation or storage sites.

10. Small generators, licensing, and commercial landfill operations.

11. No limitations involving applications of stabilization, with the exception of non-aqueous wastes.

12. Mobilization involves approximately two weeks, with standard permitting for over-the-road transportation.

13. 440 volt, 3 phase electricity, with amps dependent on extent of materials handling equipment.

14. Site preparation is included within service application.

15. Following pre-project site assessment and testing for compatibility, only a forty-eight to seventy-two hour period is required for a quality assurance program.

16. One to two days required for equipment setup with one to two days production at 50% processing rate.

17. The CHEMFIX® product is a friable, man-made clay material capable of being utilized in several useful end use applications (see Attachments B and C).

18. Yes.

19. Amendment of generator's Part A Application, federal delisting, state treatment permits, and state solid waste disposal facility permits.

20. Yes.

21. Three to nine months.

22. Process information, site and production history (variability of waste stream), material data sheets, existing permit information, site plot plans, and monitoring well locations and data.

23. Yes. Inability of regulatory and permitting pathways to differentiate between commercial treatment facilities and mobile treatment applications under interim status closures.

24. See Attachment B.

25. See Attachment B. Waste characteristics that elevate treatment costs involving materials handling difficulties associated with transport logistics and volume of material to be treated, i.e., lower volumes involve higher per unit costs.

26. CTI does not wish to participate in cost estimates for site scenarios. Generally, production costs for turnkey projects have ranged between $20.00 and $50.00 per ton of material to be treated.

If you have any questions after the reviewing this correspondence, please feel free to contact me directly.

Sincerely,

Robert A. Phelan

Robert A. Phelan
Vice President

RAP/slw

Enclosures

SUPERFUND SITE
MOBILE TREATMENT UNITS
FIXATION/SOLIDIFICATION SURVEY

Company Envirite Field Services

Address 600 West Germantown Pike, Suite 221

Town Plymouth Meeting State PA Zip 19462

Contact Person William T. Howard Tel. No. (215) 825-8877

A. Mobile Capabilities

1. Is proprietary mobile equipment for on-site fixation/solidifcation used? Please describe. Yes. Envirite Field Services has developed three proprietary operating systems to manage and stabilize a complete range of waste materials: Volume Reduction/Stabilization (VR/S) for low solids materials, In Situ (PF-5) stabilization for mid-range solids materials, and High Solids Stabilization (HSS) for high solids materials.

2. What type of standard heavy equipment items are used?

Hydraulic excavators, bulldozers, loaders, dump trucks.

3. Equipment limitations (i.e., temperature, type or volume of waste, accessibility, in situ or excavated materials, organic or inorganic materials).

It is assumed that projects will usually be completed during the time of year when the average ambient temperature is above 45°F. Quality control can be maintained at 10 to 15° lower temperature at an increase in cost of 10 to 20%.

4. Waste types successfully handled.

Give examples (i.e., volatile organics, PCBs, metals, etc.)	Forms (liquid, sludge, soil)	Concentration Range	Restrictions or Limitations
PCB	High solids	1-1000 ppm	Lined disposal cell
Hg contaminated	Sludge	165-463 ppm	Capped disposal cell
Chloro-caustic ~~dye, pigment~~	Low solids	N/A	RCRA disposal cell
Zinc plating	Sludge	Pass EP Toxicity	None
Oily emulsion (45% hydrocarbons)	Sludge	Oil 40-50%	Oil 50% max.

5. Number of units in operation three (3) delivery systems

6. Capacity of each unit Min. 25-30,000 gal/day Max. 50-90,000 gal/day-VR/S
25-30,000 gal/day 50-90,000 gal/day-PF-5
25-30,000 gal/day 50-90,000 gal/day-HSS

7. Describe any mobile units under construction or development.

Additional PF-5 units under development, HSS delivery and mix systems, VR/S mix and filtration systems.

8. Status (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for followup.

(5) All three stabilization systems are commercially available. Every project is evaluated and priced on a case specific basis. Average cost range between $.10-.25 cents/gallon of material processed.

B. Market Development

9. Your primary market areas On-site stabilization market for organic and inorganic wastes.

10. Company goals for market expansion Achieve more than 10% of the on-site waste stabilization market by 1989.

11. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your Mobile treatment unit best suited for?

Organic wastes up to 50%, inorganic wastes; minimum economic project size is 100,000 gallons or 500 cu yds, and wide range of materials from liquids to solids. In the geographic service areas associated with Envirite's fixed treatment facilities, projects smaller than 500,000 gallons are evaluated for off-site delisted treatment.

C. On-Site Utilization

12. Mobilization requirements (time, transport) Varies with project; once on-site, allow 4 hours to 1 day to set up. Typical project initiation 1-4 weeks from notification to proceed.

13. Utility requirements Power by motor generator when required.

14. Site preparation Varies with project; good access required.

15. Time requirements for testing on-site Test work completed prior to site work; Q.C. testing on a continuous basis.

16. Time requirement to bring unit on-line Immediately

17. Describe the final state of material after fixation (i.e., solid, semi-solid, compressive strength, leachabiity (EP tox), volume change, density change, delisting, ultimate disposition, potential). If a given final state is not uniformly attained, please document with actual case studies.

Stabilized liquid and sludge wastes form a homogeneous, low permeability, low leachability and high load supporting material. Volume change varies with process: 10-20% typical for PF-5, 10-20% decrease for HSS, and 60-80% decrease for VR/S.

D. Regulatory Requirements

18. Has your unit(s) ever been permitted by federal, state or local governments? X Yes ______ No

19. If so, describe type of permit(s). Closure plans

20. Do you handle permitting of your unit? We work under generator's permit. Will provide assistance in obtaining permit when requested.

21. Average time for approval N/A-See note on #20.

22. Information required of client Approved closure plan for on-site stabilization, information about process generating waste, analytical information on waste properties, and 5 gallon sample.

23. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of.

Yes. Advise client to establish a closure program for project including pre-screening work, sample confirmation and demonstration work, regulatory approval and field operations work. A team approach is recommended for most projects. The closure plan should not specify specific solidification route but specify minimum results.

E. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

24. What type of site information and oata on waste characertistics do you need to develop a general cost estimate?

Project size, type of waste (chemical and physical characteristics), sample of waste, physical layout, project goals and "Prequalification Questionnaire" (see attached).

25. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

o Representative sample of waste to confirm waste variability and site survey/visit.

o Sample variability; e.g., % dry solids.

Site Scenarios (attached)

26. Please cost out the particular components of the sites (e.g., soils, groundwater) for which your mobile unit is best suited. List any factors which could significantly elevate costs. These costs need only be rough, and only will be used as general guidelines for average costs.

Please return this completed survey questionnaire to:

Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108
ATTN: Arthur Quaglieri

HAZCON

HAZCON, Inc.
HAZARDOUS WASTE SOLIDIFICATION TECHNOLOGY
- Engineering
- Field Operations

Camp Dresser & McKee Inc.
One Center Plaza
ATTN: Arthur Quaglieri
Boston, MA 02108

April 29,1986

Dear Mr. Quaglieri:

Enclosed is the HAZCON response to your query. We appreciate the authorized delay in returning it to you. Our business has been rushed, to say the least.

Please understand that the estimated cost per cubic yard or gallon given was an estimate only. Based upon many factors, not least of which is the time of year and employment situations in various parts of the nation, estimates can vary. However, for the basic charge for treatment chemicals, etc., those will not vary appreciably.

Thank you for the opportunity to participate.

Respectfully,

Ray Funderburk
President

RF;ref

1 Encl

P.O. Box 947 • Katy, Texas 77492
(In Houston) 713/391-1085 (Outside Houston) 713/934-4500

SUPERFUND SITE
MOBILE TREATMENT UNITS
FIXATION/SOLIDIFICATION SURVEY

Company HAZCON Engineering, Inc.

Address P.O.Box 947

Town Katy State Texas Zip 77492

Contact Person Ray Funderburk, Pres. or Tel. No. (713) 391-1085
Joseph Cella, ExVP

A. Mobile Capabilities

1. Is proprietary mobile equipment for on-site fixation/solidifcation used? Please describe.

Yes, the equipment has been designed and constructed by HAZCON.

2. What type of standard heavy equipment items are used?

Rough terrain construction equipment, portable dredges, heavy truck

3. Equipment limitations (i.e., temperature, type or volume of waste, accessibility, in situ or excavated materials, organic or inorganic materials).

no limitations on environment, type of waste by volume
or chemistry or physical state (solid,fluid,sludge)

4. Waste types successfully handled.

Give examples (i.e., volatile organics, PCBs, metals, etc.)	Forms (liquid, sludge, soil)	Concentration Range	Restrictions or Limitations
acetone [illegible]	fluid	100%	none
benzene	fluid	100%	none
lead	oily sludge	265mg/l	none
barium	oily sludge	131mg/l	none
arsenic	oily sludge	2210mg/kg	none

5. Number of units in operation 2.

6. Capacity of each unit Min. 5 yd^3 hr Max. 60 yd^3 hr

7. Describe any mobile units under construction or development.

Currently constructing totally enclosed, vapor-free unit to treat volatile fluids such as acetone, ethers, etc.

8. Status (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for followup.

(4) commercially available within 6 months. Contracts already signed and others being negotiated for solvent solidification at point of spent solvent generation.

B. Market Development

9. Your primary market areas mobile treatment in remote environment

10. Company goals for market expansion regional offices (25 cities) by 1987 plus emergency response and small-quanity generator service

11. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your Mobile treatment unit best suited for?

SUPERFUND cleanup of organic sites such as former refineries or other sites with heavy organic concentrations

C. On-Site Utilization

12. Mobilization requirements (time, transport) all equipment truck or trailer mounted, set up time upon arrival accomplished in 6 to 12 hours based upon availablility of flyash or cement

13. Utility requirements water only (can be taken from local sources such as ponds, rivers, etc.

14. Site preparation no special requirements, minimal

15. Time requirements for testing on-site 2 to 4 hours

16. Time requirement to bring unit on-line system optimized within 24 hours

17. Describe the final state of material after fixation (i.e., solid, semi-solid, compressive strength, leachabiity (EP tox), volume change, density change, delisting, ultimate disposition, potential). If a given final state is not uniformly attained, please document with actual case studies.

material becomes solid (forklift in 24 hours if poured in a cement form), compressive strengths range from 1,000 - 5,000 psi, permeabilities 10^{-7}, three times denser than concrete. can be landfilled without fear of degredation.

D. Regulatory Requirements

18. Has your unit(s) ever been permitted by federal, state or local governments? ________ Yes ___X___ No

19. If so, describe type of permit(s). none sought due to newness of system. Anticipate verly little trouble permitting due to enclosed nature of units.

20. Do you handle permitting of your unit? ________ Yes ________ No

21. Average time for approval ____________

22. Information required of client ____________________________

23. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of.

E. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

24. What type of site information and data on waste characertistics do you need to develop a general cost estimate?

solids content, moisture content, oil content, accessibility.

25. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

none

Site Scenarios (attached)

26. Please cost out the particular components of the sites (e.g., soils, groundwater) for which your mobile unit is best suited. List any factors which could significantly elevate costs. These costs need only be rough, and only will be used as general guidelines for average costs.

Please return this completed survey questionnaire to:

Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108
ATTN: Arthur Quaglieri

HAZCON

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide Site

COMPONENT: Contaminated soils

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste (yd^3)
1.	Administration		$10.00
2.	Equipment		5.00
3.	Permitting		.50
4.	Pre-Operational Testing		1.50
5.	Operating Expenses (fuel, treatment additives)		45.00
6.	Mobilization - Demobilization		1.00
7.	Labor (on-site)		15.00
8.	Laboratory Analyses		.50
9.	Volume of Residuals per unit volume of waste		$78.50

20% maximum increase in volume

Disposal requirements for residuals Class I landfill (unless delisted) residuals could be stacked on site until moved to repository or could be insitu--returned to starting place as homogeneous mass or in block form

10. Tank residues--solidifed for approximately $0.40 per gallon

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Heavy Metals Site

COMPONENT: Contaminated soils and sludges (wetlands and lagoons)

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste (yd^3)
1.	Administration		$7.00
2.	Equipment		3.50
3.	Permitting		.25
4.	Pre-Operational Testing		1.50
5.	Operating Expenses (fuel, treatment additives)		35.00
6.	Mobilization - Demobilization		1.00
7.	Labor (on-site)		17.00
8.	Laboratory Analyses		.50
9.	Volume of Residuals per unit volume of waste		$65.75

no significant volumetric increase in sludges, perhaps up to 20% in soils if dry.

Disposal requirements for residuals can be insitu treated, or returned to the wetlands in the form of blocks, or blocks can be transported from site for disposition elsewhere.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB Site

COMPONENT: Contaminated soils (50-500 ppm)

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste (yd^3)
1.	Administration		10.00
2.	Equipment		5.00
3.	Permitting		1.00
4.	Pre-Operational Testing		1.00
5.	Operating Expenses (fuel, treatment additives)		$100.00
6.	Mobilization - Demobilization		5.00
7.	Labor (on-site)		25.00
8.	Laboratory Analyses		.25
9.	Volume of Residuals per unit volume of waste		$147.25

anticipated volumetric increase 20-25%

Disposal requirements for residuals solid residuals to Class I landfill

SOLIDTEK

SUPERFUND SITE
MOBILE TREATMENT UNITS
FIXATION/SOLIDIFICATION SURVEY

Company Solidtek Systems, Inc.

Address 5731 Cook Road (P.O. Box 888)

Town Morrow State GA Zip 30260

Contact Person Robert Moore Tel. No. 404/361-6181

A. Mobile Capabilities

1. Is proprietary mobile equipment for on-site fixation/solidifcation used? Please describe.

   Solidtek has several types depending on application

2. What type of standard heavy equipment items are used?

   Construction equipment/vehicles

3. Equipment limitations (i.e., temperature, type or volume of waste, accessibility, in situ or excavated materials, organic or inorganic materials).

   No limitations used for excavated materials. No limitation on size of project

4. Waste types successfully handled.

Give examples (i.e., volatile organics, PCBs, metals, etc.)	Forms (liquid, sludge, soil)	Concentration Range	Restrictions or Limitations
Solvents: PCB's,	metals, sludges of	all kinds	
Leachates - no restrictions			

5. Number of units in operation 4.

6. Capacity of each unit Min. 5-10 cy/hr Max. 150-200 cy/hr

7. Describe any mobile units under construction or development.

Development of mobil technology is ongoing

8. Status (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for followup.

Commercially available now. Hist and performance evaluation not provided

B. Market Development

9. Your primary market areas N. America and Caribbean

10. Company goals for market expansion Turnkey projects, fixed facility applications, greater utilization of present facilities

11. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your Mobile treatment unit best suited for?

Treatment units suited to most sites

C. On-Site Utilization

12. Mobilization requirements (time, transport) up to three weeks required depending on location and availability of equipment

13. Utility requirements All units are self contained

14. Site preparation Provide security, staging, possible concrete pad

15. Time requirements for testing on-site Up to several months required

16. Time requirement to bring unit on-line

17. Describe the final state of material after fixation (i.e., solid, semi-solid, compressive strength, leachabiity (EP tox), volume change, density change, delisting, ultimate disposition, potential). If a given final state is not uniformly attained, please document with actual case studies.

Solid or semi-solid depending on intended disposition

D. Regulatory Requirements

18. Has your unit(s) ever been permitted by federal, state or local governments? [✓ Yes] No

19. If so, describe type of permit(s). Fixed facilities are permitted. Field activities are normally done under owner's permit or closure plan.

20. Do you handle permitting of your unit? Yes [✓ No]

21. Average time for approval N.A.

22. Information required of client Composition properties, quantities, drawings, permits. In general all available data

23. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of.

Yes. Keep informed of changes in regulatory requirements

E. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

24. What type of site information and data on waste characertistics do you need to develop a general cost estimate?

Work statement, gross compositional analysis, physical properties

end product desired, time line, location, site details, logistics.

25. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Laboratory test results to determine formulation, dosage and

throughput rate. Treatment costs affected by institutional factors

and changed conditions in field

Site Scenarios (attached)

26. Please cost out the particular components of the sites (e.g., soils, groundwater) for which your mobile unit is best suited. List any factors which could significantly elevate costs. These costs need only be rough, and only will be used as general guidelines for average costs.

Please return this completed survey questionnaire to:

Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108
ATTN: Arthur Quaglieri

SolidTek

SolidTek Systems Inc.
5371 Cook Road • P.O. Box 888
Morrow, Georgia 30260
404/361-6181

GENERATOR'S WASTE PROFILE (GWP)

SOLIDTEK
ST # ______
Waste Code ______

Generator Name ______
Facility Address ______
______
City, State, Zip ______ ______
Technical Contact ______ (Name) ______ (Title)
Area Code ( ) Telephone # ______
Facility EPA ID # ______

Billing Address ______
______
City, State, Zip ______
Business Contact ______ (Name) ______ (Title)
Area Code ( ) Telephone # ______
Business SIC Code ______
Duns No ______

Common Name of Waste ______

Generating Process ______

CHEMICAL COMPOSITION (Totals must add up to 100%)

______ ______ %
______ ______ ______ %
______ ______ %
______ ______ %
______ ______ %
______ ______ %
______ ______ %
______ ______ %
______ ______ %

EPA Haz Waste No. ______ Reason ______
Rate of Generation ______ (Quan) ______ (Units) ______ PER (Time Interval)
Volume in Storage ______ (Quan) ______ (Units) ______ IN (Container)
Is Waste DOT Hazardous ☐ Yes ☐ No
Proper DOT Shipping Name ______
Hazard Class ______ ID No. ______
Transportation Equipment ______
Placarding ______

METALS (mg/l or ppm)

	TOTAL	LEACHATE			
			Selenium (Se)		
Arsenic (As)			Silver (Ag)		
Barium (Ba)			Copper (Cu)		
Cadmium (Cd)			Nickel (Ni)		
Chromium (Cr)			Zinc (Zn)		
Chromium, Hex			Thallium (Tl)		
Lead (Pb)					
Mercury (Hg)					

INORGANICS (mg/l or ppm)

Total CN			Bromide		
Free CN			Iodide		
Sulfide			Asbestos		
Bisulfite					
Sulfite					
Sulfate					
Phosphate					
Fluoride					
Chloride					

ORGANICS (mg/l or ppm)

Endrin			Organohalide		
Lindane			Organo-sulfur		
Methoxychlor			Mercaptans		
Toxaphene					
2,4-D					
2,4,5-T					
Phenol (ics)					
PCB					
TOC					
BOD					
COD					

PHYSICAL DESCRIPTION

Physical State ☐ Liquid ☐ Semi Solid ☐ Solid
Phases/Layering ☐ None ☐ Bilayered ☐ Multilayered
Total Solids (wt %) ______ Suspended Solids (wt %) ______
Type of Solids ☐ Organic ☐ Inorganic ☐ Mixed
Specific Gravity ______
Viscosity ☐ High ☐ Medium ☐ Low
Flash Point (°F) ______ Type ______
Boiling Point, °C ______ Freezing Point, °C ______
Vapor Pressure (mm Hg @ 25° C) ______
BTU/lb ______ % Ash Content ______
pH (Avg) ______ (Range) ______ to ______
Total Alkalinity/Acidity (%) ______
Odor ______
Color ______

HAZARDOUS PROPERTIES ☐ None

☐ Ignitable
☐ Reactive
☐ Explosive
☐ Biological
☐ Pesticide Residuals

☐ Corrodes Steel
☐ Pyrophoric
☐ Water Reactive
☐ Pathogen

☐ Toxic Vapor
☐ Shock Sensitive
☐ Radioactive
☐ Etiological
☐ Other ______

NFPA HAZARD IDENTIFICATION

TOXICITY
Oral ______
Dermal ______
Inhalation ______

PLEASE ATTACH ALL MATERIAL SAFETY DATA SHEETS, LOGISTIC SKETCHES, ANALYSIS REPORTS, HANDLING PRECAUTIONS, ADDITIONAL HAZARD INFORMATION, SUPPORT DATA & COMMENTS.

______
______
______
______

I hereby certify that I have personally examined and am familiar with the information submitted in this and all attached documents. Based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete to the best of my knowledge and ability and that all known and suspected hazards have been disclosed.

SEP 1986

Date ______ By ______ Name ______ Title ______ Signature

SolidTek

SolidTek Systems Inc
53[illegible] Cook Road • P.O. Box [illegible]
Morrow, Georgia 30[illegible]
404 361-[illegible]

MOBILE SERVICE QUESTIONAIRE

SOLIDTEK

Generator (Owner) ______________________	Billing Address ______________________
Facility Address ______________________	______________________
______________________	City, State, Zip ______________________
City, State, Zip ______________________	Business Contact ______________________ (Name) (Title)
Technical Contact ______________________ (Name) (Title)	Facility EPA ID # ______________________
Area Code ( ) Tel # ______________________	Facility NPDES Permit # ______________________

Project Name ______________________

History of the Project ______________________

Description of present conditions: ______________________

Desired Action: ______________________

Alternatives considered: ______________________

Are additional alternatives desired? ○ Yes ○ No

What is the site to be used for after the project is done? ______________________

Why is project being undertaken? ______________________

Is there ○ regulatory mandate; ○ political sensitivity; ○ public pressure;
○ other external pressures. Explain ______________________

Timing: When will contact be awarded? ____________ Starting date? ____________ Completion date? ____________
How firm is schedule? ______________________

Financial: What is owner's fiscal year? Begins ____________, ends ____________

Has owner developed an "engineering estimate" of project cost?

○ Yes, $ ____________; ○ No.

Have funds been budgeted for the project? ○ Yes, ○ No.

Have funds been appropriated/committed for release? ○ Yes, ○ No.

Are project costs to be charges against ○ Plant, ○ Division, ○ Corporate, ○ Special fund, budgets?

What is union status of the facility? ____________

Does Davis-Bacon or other rate determination apply (government projects only)?

○ Yes, ○ No. If yes, attach schedule.

Disposal: Will disposal be involved ○ Yes, ○ No. If yes, then answer the following

Will materials require treatment? ○ Yes, ○ No. Describe ____________

Is on-site disposal a possibility? ○ Yes, ○ No. If yes, ○ re-siting, ○ adjacent area, ○ somewhere else on site (Show where).

Is nearby sanitary landfill disposal indicated? ○ Yes, ○ No. Where?

(Location, owner/operation, phone number, rates, hours, etc). ____________

____

Will Material require secure landfill? ○ Yes, ○ No. If so, which one? ____

____

Does project involve ○ pumping, ○ dredging, or ○ excavation? Explain. ____________

____

____

What are the quantities of materials involved? ____________

____

____

How were those quantities determined or estimated? What are quantity error limits? ________

____

____

Are representative samples available? ○ Yes, ○ No. (Representative samples must have the same composition and properties as the material, for purposes of determining pumping and handling characteristics in addition to chemistry.)

Site Logistics: Describe on-site and access traffic routes, patterns, and any constraints

____

____

____

Identify areas available and suitable for SolidTek staging and process activities. ________

____

____

____

Attachments:

- ○Completed GWP for each waste material. For lagoons, prepare a GWP for each lagoon plus a composite GWP.
- ○Plot plan of immediate project site.
- ○Plot plan of premises.
- ○Plot plan of city, county, or area showing site location, nearby sanitary landfill(s), and traffic routings.
- ○Engineering drawing of the lagoon, warehouse, etc. (Sketch showing dimensions is OK.)
- ○Plot plan of test wells and monitoring points; Soils/hydro-geo investigation report: description of monitoring program.
- ○NPDES Permit
- ○USEPA notification (RCRA-Part A)
- ○Applicable parts of RCRA-Part B
- ○SPCC and/or Contingency plans
- ○All warning letters, notice of violations, and dispositions for last 3 years.
- ○Historical summary record of violations previously.
- ○Ground level or aerial photos of the jobsite and facility.
- ○Facility organization chart
- ○Local and Regional Regulatory Contracts

Are there any other factors or information that might impact the ease or difficulty of performing the project, or that otherwise would be useful, that are not stated above?
○Yes ○No. Explain. ______________________________

____

____

I hereby certify that I have personally examined and am familiar with the information submitted in this and all attached documents. Based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete to the best of my knowledge and ability and that all known and suspected hazards have been disclosed.

Date: ______________ By: ______________________________
Name Title Signature

Area is ○Concrete ○Asphalt, ○Stone, ○Other ____________________

Loading bearing capacity ____________________

Are there likely to be neighbor problems for normal amounts of noise, dust, light, etc?

○Yes ○No. Explain. ____________________

Are there restrictions on hours worked ○Yes ○No. Explain ____________________

Are there any overhead wires, pipes, bridges, or other overhead hazards or obstructions that would interfere with trucks, cranes, or other equipment? ○Yes ○No.

Describe ____________________

____

____

Is electricity available (230 V, 3 phase, 150 amp?) ○Yes ○No.

○ Other ____________________

Is process water available? ○Yes. Volume __________ gpm. Source ________

○No ○Other Supply ____________________

Is plant air available (90 psi, 200 cfm) ○Yes ○No ○Other ____________

Are worker facilities available ○lavatory, ○showers, ○change room,

○lunchroom, ○restaurant, ○ Other ____________________

Are any permits required ○Yes, ○No. (Permits are owner's responsibility.)

Owners Support Available:

○Loading dock or ramp
○Fork truck
○Pumps
○Manpower
○Other heavy equipment

____

____

____

○Telephone
○Copier
○Clerical
○Supplies
○Security

____

____

____

Community Logistics (If applicable)

Identify appropriate lodging facilities for work crews ____________
Location of dining facilities ____________________
Maintenance and supply vendors: ○readily available locally, ○other location ____________________ ○import everything.

VELSICOL CHEMICAL CORPORATION

2603 CORPORATE AVENUE
SUITE 100
MEMPHIS TN 38132
(901) 345-1788

April 21, 1986

Arthur L. Quaglieri
Camp Dresser and McKee, Inc.
One Center Plaza
Boston, Massachusetts 02108

Re: Your letter
Superfund Sites/Fixation-Solidification Survey

Dear Mr. Quaglieri:

I am returning the questionnaire concerning treatment technologies for Superfund sites.

As indicated in the questionnaire, Velsicol follows a predetermined step-by-step procedure in evaluating a sludge sample, and this assures a very cost effective route. Velsicol has found that generally it would cost between $0.15 and $0.50 to effect solidification of one gallon of sludge.

I regret that due to the time constraint mentioned in your letter and the lack of pertinent details, Velsicol is unable to provide a professional engineering opinion on the various scenarios submitted by you.

Velsicol will be pleased to provide all the necessary non-proprietary information to assist business evaluations of Camp Dresser and McKee, Inc. and EPA project officers. I would like to point out that Velsicol has positioned itself to seek a patent protection of this technology.

We at Velsicol look forward to serving this important environmental market need.

Yours truly,

VELSICOL ENVIRONMENTAL CENTER

P.M. Trivedi

PMT/ddc

Attachment

cc: C.R. Hanson
D.R. Marks
T.W. Shaffer

SUPERFUND SITE
MOBILE TREATMENT UNITS
FIXATION/SOLIDIFICATION SURVEY

Company Velsicol Chemical Corporation

Address 2603 Corporate Avenue, Suite 100

Town Memphis State Tennessee Zip 38132

Contact Person P. Kumar Trivedi Tel. No. (901)345-1788

A. Mobile Capabilities

1. Is proprietary mobile equipment for on-site fixation/solidifcation used? Please describe.

   No

2. What type of standard heavy equipment items are used?

   Conventional earthmoving and mixing equipment

3. Equipment limitations (i.e., temperature, type or volume of waste, accessibility, in situ or excavated materials, organic or inorganic materials).

   Viscosity of material, general environmental temperatures as these relate to operation of equipment.

4. Waste types successfully handled.

Give examples (i.e., volatile organics, PCBs, metals, etc.)	Forms (liquid, sludge, soil)	Concentration Range	Restrictions or Limitations
Organic, heavy, oily, resinous sludges	Semisolid Sludge	Concentration of organics ranged up to 45%	No specific limitations experienced

5. Number of units in operation Currently, none .

6. Capacity of each unit Min.______ Max.______

Variable. Depending on the site and sludge volume.

7. Describe any mobile units under construction or development.

None

8. Status (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for followup.

Commercially available now. See attachment.

B. Market Development

9. Your primary market areas On-site solidification of sludges.

10. Company goals for market expansion Velsicol is positioning itself to acquire a U.S. patent protection for its technology. A strong commitment exists to service needs of domestic and foreign markets.

11. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your Mobile treatment unit best suited for?

The solidification is effected using conventional earthmoving equipment. Velsicol's extensive testing has shown distinctly superior results with a variet of types of sludges.

C. On-Site Utilization

12. Mobilization requirements (time, transport) Availability of equipment and transportation time for reagents would be the principal issues. These activities may need 3-4 weeks.

13. Utility requirements To service construction office and health/hygiene trailers.

14. Site preparation Accessibility for the equipment.

15. Time requirements for testing on-site 1-3 weeks

16. Time requirement to bring unit on-line 3-6 weeks

17. Describe the final state of material after fixation (i.e., solid, semi-solid, compressive strength, leachabiity (EP tox), volume change, density change, delisting, ultimate disposition, potential). If a given final state is not uniformly attained, please document with actual case studies.

Please refer to the attachment.

D. Regulatory Requirements

18. Has your unit(s) ever been permitted by federal, state or local governments? ________ Yes xxx No

19. If so, describe type of permit(s). N/A

20. Do you handle permitting of your unit? ________ Yes xxx No

21. Average time for approval N/A

22. Information required of client a) A complete characterization of a representative sample. b) Testing to develop cost effective formulation.

23. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of.

The nature and quantity of sludge would be the principal issues.

VELSICOL

E. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

24. What type of site information and data on waste characertistics do you need to develop a general cost estimate?

Waste characterization, volume, preliminary tests, cost of reagents, depth of pond, underlying material, etc.

25. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Transportation of raw materials, accesibility, nature of waste (e.g. viscosity, water/organics contents) etc.

Site Scenarios (attached)

26. Please cost out the particular components of the sites (e.g., soils, groundwater) for which your mobile unit is best suited. List any factors which could significantly elevate costs. These costs need only be rough, and only will be used as general guidelines for average costs.

Please return this completed survey questionnaire to:

Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108
ATTN: Arthur Quaglieri

WESTINGHOUSE

Westinghouse
Hittman Nuclear
Incorporated

A Westinghouse
Subsidiary

9151 Rumsey Road
Columbia, Maryland 21045
(301) 964- 5043

May 9, 1986

Mr. Arthur L. Quaglieri
Camp Dresser & McKee, Inc.
One Center Plaza
Boston, Massachusetts 02108

Subject: Technical Performance and Cost Information for Mobile fixation/solidification

Dear Mr. Quaglieri:

The enclosed survey forms provide a brief overview of our capabilities in the area of mobile solidification services and equipment. We have over eighty years of experience with processing radioactive wastes from commerical nuclear plants, where the operation is performed under very controlled conditions. We are presently interested in applying this technology and experience base in the hazardous waste market. I feel our systems should be relatively easy to utilize in site remediation activites, provided the waste material is compatible with the solidification process and waste chemistry. Our work with nuclear waste has also resulted in our development of detailed solidification formulations and test procedures for a wide variety of waste types.

I have not completed the part of the survey associated with the scenarios, as those were more applicable to mobile wastewater treatment. The costs associated with our batch type mobile solidification services range from $50 to $80 per cubic foot of waste. The cost for the continuous processor is slightly less.

In addition to our solidification services, we provide: a mobile water treatment system for treating PCB contaminated water, portable demineralization systems, and a mobile 1000 ton high force drum compactor.

I trust this information is responsive to your needs. If you have any further questions or require additional information, please call me at (301) 964-5043.

Sincerely,

Robert M Lugar

Robert M. Lugar
Senior Applications Engineer

RML:sbf

WESTINGHOUSE

SUPERFUND SITE
MOBILE TREATMENT UNITS
FIXATION/SOLIDIFICATION SURVEY

Company Westinghouse Hittman Nuclear Incorporated

Address 9151 Rumsey Road

Town Columbia State Maryland Zip 21045

Contact Person Mr. C. Robert Conner Tel. No. (301) 964-5035

A. Mobile Capabilities

1. Is proprietary mobile equipment for on-site fixation/solidifcation used? Please describe.

In-container mobile solidification systems used for batch processing of up to 1,100 gallons per container, high shear mixer and bulk cement silo for continuous processing applications.

2. What type of standard heavy equipment items are used?

Forklift truck or crane required (10 Ton)

3. Equipment limitations (i.e., temperature, type or volume of waste, accessibility, in situ or excavated materials, organic or inorganic materials).

Liquids and semi-solids only. Typical solidification agent is Portland cement.

4. Waste types successfully handled.

Give examples (i.e., volatile organics, PCBs, metals, etc.)	Forms (liquid, sludge, soil)	Concentration Range	Restrictions or Limitations
Calcium Fluoride	sludge		
Evaporator Concentrates*	slurry		
Waste Oil *	liquid		
Spent Ion Exchange Resin*	slurry		
Filter Sludges*	sludge		
Activated Carbon*	slurry		
Aluminum Oxide Grit*	sludge		
Diatomaceous Earth*	slurry		

* indicates this waste type has been processed in a radioactive environment.

5. Number of units in operation 12 in-container systems, 1 continuous processor.

6. Capacity of each unit

	Min.	Max.
In-container:	1,100 gal/8 hrs	2,200 gal/8 hrs
Continuous processor:	5 gpm waste input	15 gpm waste input

7. Describe any mobile units under construction or development.

High torque hydraulic drive in-container solidification system (1500 gal per container). Additionally, we are investigating immobilization/stabilizatior of heavy metal wastes.

8. Status (1) R&D, (2) pilot, (3) demo, (4) commercially available 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If available soon, provide status report and/or name of technical staff to contact for followup.

5 - See attached literature for current solidification capabilities.

B. Market Development

9. Your primary market areas Commercial Nuclear Facilities

10. Company goals for market expansion Solidification of ash, sludge, other residues resulting from on-site treatment of hazardous waste. Private or Superfund sites. Sites requiring solidification and packaging of end product.

11. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your Mobile treatment unit best suited for?

Sites with radioactive waste requiring solidification, sites with hazardous wastes compatible with cement solidification, especially liquids with low organic content, ion exchange resins, diatomaceous earth, powdered carbon.

C. On-Site Utilization

12. Mobilization requirements (time, transport) Mobile in-container systems available within one (1) week. Continuous processor, if available, can be mobilized and setup within two (2) weeks.

13. Utility requirements See Attached Interface Requirements Document

14. Site preparation See Attached Interface Requirements Document

15. Time requirements for testing on-site 1 day

16. Time requirement to bring unit on-line 1 day

17. Describe the final state of material after fixation (i.e., solid, semi-solid, compressive strength, leachabiity (EP tox), volume change, density change, delisting, ultimate disposition, potential). If a given final state is not uniformly attained, please document with actual case studies.

Solid, free standing monolith, or a mere stable product meeting the class B and C waste form requirements of 10CFR61, including ANS 16.1 (leach)

D. Regulatory Requirements

18. Has your unit(s) ever been permitted by federal, state or local governments? X Yes ____ No

19. If so, describe type of permit(s). Operate under NRC license of each commercial nuclear reactor plant. No work under EPA to date.

20. Do you handle permitting of your unit? ____ Yes ____ No

21. Average time for approval ____

22. Information required of client ____

23. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of.

No. Topical Report for solidification and process submitted to NRC and presently under review for approval. Test Procedures and quality assurance procedures have been devoloped to develop and utilize new formulations for specific waste streams.

E. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types. These costs can be rough, (ranges are acceptable) and will be used only as general guidelines for average costs.

General Cost Guidelines

24. What type of site information and data on waste characertistics do you need to develop a general cost estimate?

Availability of utilities (power, water, air), volume of waste, physical nature of waste, general chemical description of waste, weather protection, amount of of waste handling required.

25. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Packaging efficiency (volume of waste/volume of container) is a driving force determining number of liners, cement required, total time, and total labor.

Site Scenarios (attached)

26. Please cost out the particular components of the sites (e.g., soils, groundwater) for which your mobile unit is best suited. List any factors which could significantly elevate costs. These costs need only be rough, and only will be used as general guidelines for average costs.

Please return this completed survey questionnaire to:

Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108
ATTN: Arthur Quaglieri

SECTION 6
COMPANIES OFFERING THERMAL TREATMENT PROCESSES

This section presents inventories of some companies offering mobile thermal treatment systems. Only those companies that provided detailed information are included in this section. Three major thermal processing modes with mobile applications are incineration, pyrolysis and wet oxidation. Specific processes within each of these general categories are listed below.

Incineration	Pyrolysis	Wet Oxidation
Rotary Kiln	Plasma Arc	Critical Water
Liquid Injection	Advanced Electric Reactor	Wet Air
Fluidized Bed		
Infrared		

Operating conditions vary between the three process categories. In incineration, controlled combustion occurs under net oxidizing conditions. In pyrolysis, thermal decomposition occurs when wastes are heated in an oxygen-deficient atmosphere. In wet oxidation, organic materials are broken down in a water solution or suspension.

Mobile thermal systems, like fixed thermal facilities, may produce solid (e.g., ash/soil), liquid (e.g., scrubber liquor) and gaseous (i.e., off-gases) waste streams. Depending upon the original waste stream, process residuals/effluents may require further treatment.

An increasing number of companies are involved in the application of thermal treatment technologies as mobile systems. Available services include both companies that will own and operate mobile systems and those that will design and construct mobile units on a contractual basis. Of those companies offering mobile thermal treatment systems, it is evident that a large number of firms are still in the process of developing mobile units. Mobile systems that have been constructed to date range from pilot and demonstration units to full-scale commercial systems. Due to the large number of companies offering mobile systems, companies were included here only if they responded to the survey and met both of the following criteria:

- o Company has a mobile system in operation now (pilot, demonstration or full-scale).
- o Company currently has a full-scale (i.e., commercial) mobile system or will within the next six to eight months.

TABLE 6.1
COMPANIES OFFERING MOBILE UNITS FOR THERMAL TREATMENT

Company	Thermal Technology	Waste Types Handled	Mobile System Status	Capacity
DETOXCO	Rotary kiln	Combustible wastes; soils contaminated with combustibles	Demonstration-scale system operating.	3000 lb/hr soils
ENSCO Environmental Services	Rotary kiln	Organic-contaminated solids, liquids, sludges, soil; organics include PCBs, dioxins	Full-scale systems operating	35 MM Btu/hr solids to rotary kiln 10,000 lb/hr, liquids to rotary kiln 3,000 lb/hr, liquids to sec. comb. 4,000 lb/hr.
GA Technologies Inc.	Circulating fluidized bed	Organic-contaminated solids, liquids, sludges, soil	Mobile system under design	9 MM Btu/hr 10,000 lb/hr soil 600 lb/hr hydrocarbons
J.M. Huber Corporation	Advanced electric reactor	Organic-contaminated solids, liquids, soil; organics include PCBs, dioxins, chemical warfare agents	Pilot-scale system operating	3000 lb/hr
Modar Inc.	Supercritical water oxidation	Organic-contaminated liquids	Pilot-scale system operating	30 gal/day of organic material in an aqueous waste containing 1-100% organics
Shirco Infrared Systems Inc.	Infrared incineration	Organic-contaminated solids, sludges, soil; organics include PCBs, dioxins; explosives	Pilot-scale system operating	100 lb/hr
Waste-Tech Services Inc.	Fluidized bed	Organic-contaminated solids, liquids, sludges, soil	Demonstration-scale system operating	Not available
Winston Technology	Rotary kiln	Organic-contaminated solids, liquids, sludge, soil; organics include PCBs	Full-scale systems constructed (awaiting trial burn)	8MM Btu/hr
Zimpro Inc.	Wet air oxidation	Organic-contaminated liquids, sludges	Full-scale systems operating	600 gal/hr

DETOXCO INC.

Hazardous Waste Processing Equipment

June 6, 1986

Mr. Colin W. Baker
Camp Dresser & McKee Inc.
One Center Plaza
Boston, Massachusetts 02108

Dear Mr. Baker;

I have responded to the questionare we received from you a couple of weeks ago. I am sorry we were not able to respond sooner. You will note that we did not address each site senario with specific responses concerning price, because we consider much of it to be proprietary. However, we did provide you with our "ball park" figures for incineration. In addition, we have attached copies of our equipment specifications for your survey.

Sincerely yours,

Kelly McMahon

KRM/ebh

2700 YGNACIO VALLEY RD., SUITE 320 • WALNUT CREEK, CALIFORNIA 94598 • (415) 930-7997

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company DETOXCO Inc.

Address 2700 Ygnacio VAlley Rd.

Town Walnut Creek, State Ca Zip 94596

Contact Person Telephone 415 930-7997

B. Process Characteristics

1. Thermal treatment process available in mobile units. Describe briefly.

Mobile Thermal Destruction System (MTD) in various sizes and capacities.

These incineration units are scaleups of the EPA developed mobile incinerator (See attached specifications)

2. Process unit(s) that comprise mobile system

See attached specifications, includes rotary kiln incinerator, secondary combustion chamber, quench, particulate filter, and scrubber.

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s))

1800°F KIln, 2200°F Secondary Combustion Chamber, 2 Second residence time in the secondary combustion chamber, negative pressure (less severe conditions as appropriate)

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DETOXCO

4\.

Waste types handled Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations
Combustible wastes, aqueous wastes contaminated with			
Combustible, soils contaminated with combustibles			

5. **Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %)**

Design for minimum DRE of 99.9999%

6. **List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).**

Non-incineratable wastes

7. **Give the number of mobile units in operation** One

8. **Give the capacity of each unit:**

Minimum 200 Lb/Hr. Soils **Maximum** 3000 Lb/Hr. Soils

9. **Give the scale of each unit (i.e., pilot, full)** Demonstration

10. **Describe any mobile units under construction or development**

45 MM BTU/HR Rotary Kiln Incineration System

94 MM BTU/HR Rotary Kiln Incineration System

11. **Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.**

Contact Robert McMahon for further information

at 415-930-7997

C. Market Development

1. **Your primary market areas** Toxic Waste Incineration, Site Cleanup

2. **Company goals for market expansion** Proprietary

6-1

3. **The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?**

Sites contaminated with combustible toxic/hazardous constituents

D. On-Site Utilization

1. **Mobilization requirements (time, transport)** The systems are transportable over the road. The transport and installation time is less that one month.

2. **Utility requirements** Fuel, water, electricity

3. **If required utilities are not available at site, can you provide them?**

yes

4. **Specify site preparation/space requirements** various

5. **Time/labor requirement to bring unit on-line (including testing)**

Less than four weeks

6. **Number of personnel required for operation** 24

7. **Time/labor requirement to dismantle unit** Less than four weeks

8. **Equipment decontamination required** Burn-out the interior of the system with fuel for several hours.

9. **What residuals/effluents are produced from your mobile unit?**

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal
Wastewater		Waste/Site Specfic	Can be delisted depending on the waste
Ash		Waste/Site Specific	Can be delisted depending on the waste

10. **Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly**

No

11. **Specify utility requirements for above** N/A

12. **Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)**

DETOXCO will provide complete services or will incinerate on a "pile-to-pile" basis as a subcontractor.

E. **Regulatory Requirements**

1. **Has your unit(s) ever been permitted by federal, state, or local governments?** X **Yes** ____ **No.**

If so, describe type of permit(s) below.

EPA Region II (New Jersey) for high BTU wastes

EPA Region VII (Missouri) for dioxin contaminated soils

2. **Do you handle permitting of your unit?** X **Yes** ____ **No**

3. **Average time for approval** Varies depending on site specific requirements.

4. Information required of client Description of wastes to be processed, site characteristics

5. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

regulatory approval can be a significant time factor

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value)

BTU value, Cl content, physical form

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Utilities cost and availability, physical form of the material to be incinerated, chemical characteristics.

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

DETOXCO

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: ____________________

COMPONENT: ________________

Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1. Administration	________	________
2. Equipment	________	________
3. Permitting	________	________
4. Pre-Operational Testing	________	________
5. Operating Expenses (fuel, treatment additives)	________	________
6. Mobilization - Demobilization		
(Local - 100 miles)	________	________
(Non-local - 1000 miles)	________	________
7. Labor (on-site)	________	________
8. Laboratory Analyses	________	________

9. Volume of Residuals per unit volume of waste

____

Treatment requirements for residuals ______________________________

____

____

*NOTE: DETOXCO has detailed computer programs to perform costs analyses of treatment operations. These computer programs and the results of analyses are proprietory. A "ballpark" figure for the cost of incineration utilizing DETOXCO's equipment varies from $150/ton to $450/ton.

ENSCO

(615) 794-1351

ensco
environmental
services

PYROTECH DIVISION
Third Floor, 1st Tennessee Bank Bldg
Franklin, Tennessee 37064

April 22, 1986

Mr. Anthony M. Lore
Camp Dresser & McKee, Inc.
One Center Plaza
Boston, Massachusetts 02108

Dear Mr. Lore:

Enclosed is ENSCO's response to the EPA questionnaire accompanying your April 4 letter. If you desire additional information, please contact Mr. Gary Martini in our Little Rock office, (501) 375-8444.

Sincerely,

Robert J. McCormick

Robert J. McCormick
Marketing Representative

Enclosure

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company ENSCO ENVIRONMENTAL SERVICES

Address 1015 LOUISIANA STREET

Town LITTLE ROCK State ARKANSAS Zip 72202

Contact Person GARY MARTINI Telephone (501)375-8444

B. Process Characteristics

1. Thermal treatment process available in mobile units. Describe briefly.

MWP-2000 rotary kiln incineration system.

* Virtually any type of waste feed

* Heat recovery and particulate/acid gas scrubbing

* 35 MM Btu/hr thermal capacity

* 4-5 ton/hr soil capacity

2. Process unit(s) that comprise mobile system (1) Rotary kiln & feed equipment, (2) cyclones & ash drag, (3) secondary combustor, (4) waste heat boiler, (5) quench & packed tower scrubber, (6) ejector scrubber & stack, (7) brine neutralization/concentration system, (8) BFW treatment system, (9) misc. liquid tanks, and (10) control room & laboratory.

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s))

Operating Parameter	Kiln	Secondary Combustor
Temperature, °F	1200-1800	1400-2400
Residence time	Solids 30-40 min	Gas 1.7-2.2 sec at 2200°F
Pressure, in. WC	-1/4 -1/2	-1 1/2 -2

4.

Waste types handled Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations

* Virtually any physical form of waste

-- liquid, slurry, sludge, or solid.

* Oversized debris and drums crushed or shredded to minus 2-in

for feeding.

* Virtually any chemical composition other than high Br, F, or P.

* No limitation on volatility or heating value.

* PCB's/dioxins/highly chlorinated organics readily handled.

5. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %) In May 1986, trial burn DRE results will be available for PCB, carbcn tetrachloride, perchloroethylene, trichloroethane, chlorobenzene, and trichlorobenzene. Pre-trial burn tests indicated >99.9999% for all compounds.

6. List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).

150,000 tons is maximum practical project size for MWP-2000 system. Larger project would dictate custom-designed system.

7. Give the number of mobile units in operation Three identical MWP-2000 systems.

8. Give the capacity of each unit:

Minimum 8MM Btu/hr (at maximum burner turndown) Maximum 35MM Btu/hr

9. Give the scale of each unit (i.e., pilot, full) All commercial scale.

10. Describe any mobile units under construction or development

Additional MWP-2000 systems will be fabricated as needed to meet market demand. Larger, custom-designed systems may be fabricated for specific applications.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

Sydney Mines Site, Hillsborough County, Florida

- January 1985 to January 1986
- 11,000 cubic yards oily sludge, septage sludge, & soil

C. Market Development

1. Your primary market areas Hazardous waste site cleanup

2. Company goals for market expansion (1) Play leading role in site cleanup market, and (2) expand transportable incineration market to include contract waste disposal service at generator plant site.

3. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Any site, with the exceptions noted in questions No. B4 & No. B6 above.

D. On-Site Utilization

1. Mobilization requirements (time, transport) 15-20 tractor trailer loads, depending on application. Generally 6 weeks for equipment setup.

2. Utility requirements Power: 480v, 800 amp service
   Water: 50 gpm process, 5 gpm sanitary

3. If required utilities are not available at site, can you provide them?

   Yes.

4. Specify site preparation/space requirements 150 ft by 150 ft graded, graveled area for incinerator setup. Concrete slab for kiln setting. 1-2 acres total with staging & support areas.

5. Time/labor requirement to bring unit on-line (including testing) Generally, 1-2 weeks shakedown and startup.

6. Number of personnel required for operation 20-30, depending on application.

7. Time/labor requirement to dismantle unit 4-6 weeks.

8. Equipment decontamination required 48-hr burn with clean fuel plus steam cleaning of equipment exterior.

9. What residuals/effluents are produced from your mobile unit?

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal
Soil/solids	Ash	None	Backfill on site. Landfill if toxic metals present.
Chlorinated/ sulfonated waste	Dilute brine	None	POTW (preferred)
	Conc. brine	None	Deep well if delisting requirements too onerous

10. Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

Kiln bottom ash system includes water quench tank, dual drag-chain conveyor, & 20 cubic yard staging bins. Dual cyclones prevent ash carryover to combustor. Brine system includes neutralization tank, steam heated concentrator, & 1-3 frac tanks.

11. Specify utility requirements for above

Minor fraction of total for system.

12. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

ENSCO will provide a complete turnkey service, or serve as a subcontractor for incineration services only.

E. Regulatory Requirements

1. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ____ No.

If so, describe type of permit(s) below. State of Florida Air, Water and Solid Waste; State of Arkansas Air; Region VI RCRA (pending); National TSCA (pending).

2. Do you handle permitting of your unit? X Yes ____ No

3. Average time for approval Two months for State approval, approximately nine months for TSCA approval and twelve months for RCRA approval.

4. Information required of client Detailed site and waste description.

5. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of Yes. RCRA approval will be a significant time factor as long as a separate Part B is required for each site (other than CERCLA sites). Public opposition is the most important consideration.

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value)

Waste: Total volume, physical form, Btu/lb, moisture & ash

Site: Location, type of excavation (dry, wet, pond dredge, etc.)

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Waste: Density, viscosity, flash point, reactivity, corrosivity, toxicity, %Cl, S, P, Br, F, ash composition

Site: Soil type, topography, space limitations, hydrology, surface water & population proximity, local regulations, power & water availability, public perception of project.

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

SITE SCENARIOS

(1) LEACHATE SITE

Incineration would not be appropriate for this site.

(2) PESTICIDE SITE

On-site incineration would be appropriate for treatment of the tank residues, contaminated soil, and pesticide-contaminated debris.

Insufficient information is provided to estimate prices for tank residue and debris incineration.

Assumed soil characteristics are:

- 64,000 tons total (1.6 ton/cubic yard bank)
- 15-20% moisture
- Nil heating value

Total incineration price: $22 MM
Unit price: $340/ton

Incineration price includes all labor, material, and equipment for mobilization, startup, soil incineration, and demobilization.

(3) PCB SITE

On-site incineration would be appropriate for the 4,000 cubic yards of sludge and 20,000 cubic yards of soil.

Assumed waste characteristics are:

- 4000 tons sludge (1 ton/cubic yard)
- 7500 Btu/lb sludge
- 34,000 tons contaminated sand (1.7 ton/cubic yard bank)
- 20% moisture
- Nil Btu/lb sand

Total incineration price: $18 MM
Unit price: $480/ton

Incineration price includes all labor, material, and equipment for mobilization, startup, sludge and sand incineration, and demobilization.

(4) HEAVY METALS SITE

Incineration would not be appropriate for this site.

GA

GA Technologies

GA Technologies Inc.
PO BOX 85608
SAN DIEGO, CALIFORNIA 92138
(619) 455-3000

May 30, 1986

Mr. Anthony M. LoRe
Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108

Reference: Letter from CDM (LoRe) to GA (Vrable), 4/4/86.

Dear Mr. LoRe:

This in in response to the reference letter. Thank you for sending us a copy of your survey; GA is happy to provide you with the information requested.

We have enclosed copies of the completed forms plus narrative statements and costs on the scenarios where circulating bed combustion (CBC) is the major unit operation involved. We have also enclosed a package of technical information on the CBC which supplements the data on the completed form.

Please let me know if you need further information on GA's transportable CBCs. Also, if you are able to do so, GA would appreciate obtaining a copy of your completed report to EPA on this matter.

Sincerely,

H. R. Diot

Harold R. Diot
Manager, Marketing

HRD:mat
Attachments

10955 JOHN JAY HOPKINS DR., SAN DIEGO, CALIFORNIA 92121

[illegible]

GA

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company GA Technologies Inc.

Address PO Box 85608

Town San Diego State CA Zip 92138

Contact Person Harold R. Diot Telephone (619) 455-3045

B. Process Characteristics

(More information is included in the enclosed brochures and papers.)

1. Thermal treatment process available in mobile units. Describe briefly.

Transportable circulating bed combustor (CBC), an advanced, improved type of fluidized bed combustion.

2. Process unit(s) that comprise mobile system

Combustion chamber, solid/liquid/slurry feeders, air fans, ash removal, coolers, bag-house filters, controls/instruments/monitors, auxiliary fuel system.

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s))

Temperature: 1400-1800^{o}F; residence time for gases: ∿2 seconds; residence time for solids: minutes to hours; pressure: ambient to slightly negative.

4\.

	Waste types handled Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations
1.	PCB in soil	solid	50-10,000 ppm PCB	All CBC applications require
2.	Chlorinated Hydrocarbon	solid, liquid	Up to 50% chlorine	<1-inch ring size solid feed.
3.	Spent Potliners from Aluminum Smelting	solid	Any	Also, low-melting constituents
				(<1600°F) can cause difficulty.
4.	Oily wastes	sludge	Up to 90% H_2O, 10% sludge	
5.	Refuse derived fuel	solid	--	
6.	Activated carbon	solid	--	
7.	Depleted uranium machining	sludge	--	

5. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %) __________

1. PCB in soil: >99.9999% DRE
2. Various chlorinated hydrocarbons: >99.99% DRE

6. List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).

Large pieces of waste that cannot be shredded to <1-inch ring size (i.e., transformers, capacitors, engine blocks, etc.)

7. Give the number of mobile units in operation One (another is in design/ procurement)

8. Give the capacity of each unit:

	Existing Unit		Future Unit
Minimum	2 million Btu/hr	Maximum	9 million Btu/hr
	∿1 ton/hr soil		∿5 ton/hr soil
	150 lb/hr hydrocarbons		∿600 lb/hr hydrocarbons

9. Give the scale of each unit (i.e., pilot, full) The existing unit is currently in a pilot plant, but has some applications to industrial use. The future unit is in design, and is a transportable unit. Larger size non-transportable units also have industrial applications.

10. Describe any mobile units under construction or development

The future unit described above is under A-E design and procurement for application to soil cleanup. It is transportable by means of truck-trailers in a series of modules, which are erected at the site.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, [✓ (4) commercially available in 6-8 months], (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

Technical staff contact: Harold R. Diot (619) 455-2383

Alternate contact: D. D. Jensen (619) 455-2517

C. Market Development

1. Your primary market areas PCB-contaminated soil, spent potliners from aluminum smelting

2. Company goals for market expansion Chemical plant wastes, military toxic/hazardous waste, waste oil and oily waste.

3. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

PCB-contaminated soil, about 10,000 cubic yards or more. RCRA chemical wastes and waste sites; about 6 months or more residence. Aluminum smelters with continuous generation of spent potliners.

D. On-Site Utilization

1. Mobilization requirements (time, transport) About 4-6 weeks to install at site, about 3-4 weeks to demobilize. Transport is via about 6-8 tractor-trailers.

2. Utility requirements Electricity - 200 kw

Gas/Oil - 6.5 million Btu/hr for soil treatment

0 for feeds with heat contents >3000 Btu/lb.

3. If required utilities are not available at site, can you provide them?

Yes.

4. Specify site preparation/space requirements Requires about 20 X 60 ft. for burner, trailer space for 1 control trailer and a lab trailer, and soil preparation equipment space. Head height of burner is about 50 ft.

5. Time/labor requirement to bring unit on-line (including testing)

After installation, start-up/checkout is done in 2 weeks.

6. Number of personnel required for operation 3 per shift (total of about 12 persons for continuous operation).

7. Time/labor requirement to dismantle unit 3 weeks

8. Equipment decontamination required Depends upon application. Soil-treatment application (PCBs) requires primarily removal of soil by water washing and scrubbing.

9. What residuals/effluents are produced from your mobile unit?

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal
PCB-Soil	Flue gas, ash	None	Soil returned to site.
Spent Potliners	Flue gas, ash	Scrub flue gas for HF	Landfill
Chemical Plant Wastes	Salts, ash, flue gas	None	Landfill

10. Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

Does not constitute a significant component.

11. Specify utility requirements for above N.A.

12. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

All are included in GAs services.

E. Regulatory Requirements

1. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ____ No.

If so, describe type of permit(s) below. Nationwide TSCA permit for PCB-soil treatment in 2-million Btu/hr unit. RCRA RD&D permit in final review.

2. Do you handle permitting of your unit? X Yes ____ No

3. Average time for approval TSCA: 3-4 months (with initial permit now in place).
RCRA: Initial permit - 12-28 months (currently GA is 3/4 through this process). Subsequent permits: 4-6 months.

4. Information required of client See enclosed waste survey form. Includes: waste quantity, composition, heat value, utility costs, requirement for steam cogeneration.

5. Has regulatory approval been a significant time factor in the past? Yes. Please list issues that the client should be aware of TSCA (toxic waste) permits are generic and for a transportation unit apply throughout the US. RCRA (hazardous waste) permits are site-specific, and must be obtained for each site based on a trial burn in the unit at the site. This is more time-consuming than in the case of TSCA sites.

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value) See enclosed waste survey form, and E4 above for basic information needed in GA's preparation of Budgetary Cost Estimates. Key parameters are: quantity of waste, heat content, and moisture content.

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

   GA provides firm proposals for its services based upon detailed amounts and characteristics of waste, site sampling data and layout description, specific site limitations, special considerations of each project and customer needs, and other intangibles involved in any given situation.

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Comments or cost analyses for these scenarios are attached.

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

Parameter	Leachate Data		Pollutant Limitation for Discharge to WWTP (1)
	Average	High	
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130 (2)

---

(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

Leachate Site Scenario

This scenario does not reflect an optimum application of GA's CBC. At 2,000 gal. per day leachate rate, the amount of waste is well below the capacity of GA's smallest unit. That is, our pilot plant unit could treat about 5,000 gal. per day of leachate. With throughputs at this low level, the unit costs of treating the waste, particularly labor, are magnified out of their optimum levels, which are attained when flow rates of 20,000 gal. per day or higher are involved.

Even at these higher flow rates, the use of an incinerator, CBC or any other type, to serve as a boiler/evaporator of contaminated water is not the most energy-efficient means of performing the cleanup. If there is a source of energetic toxic/hazardous waste that can be used as the fuel to perform the water evaporation, there is a possibility of economic operation; otherwise the cost of oil, gas, or coal in an incinerator favors other means of cleanup.

GA suggests the following technical approach to this scenario, based upon a recent paper that discusses the treatment of hazardous waste leachate.(1) The basic unit operation of adsorption of impurities on an activated carbon bed is probably a good choice. If necessary, flocculation to remove suspended solids and some metals might be necessary prior to treatment in the carbon bed. The product of these two steps would be 2,000 gal. per day of water meeting the requirements of the waste water treatment plant specified in your scenario plus sludge from the flocculant treatment (400-600 lb/day) and spent activated carbon from the filter (about 20 lb/day). The sludge and spent carbon can be accumulated and campaigned through a CBC unit together with any base load that the unit is treating. The incremental cost of treating this small amount of additional material in a CBC would be very low. The result of the CBC treatment would be clean flue gas and about 300 lb/day of flyash/bed ash, which would require disposal in a controlled landfill because of the residual metals content. (No incinerator can remove the metals to a level allowing direct, uncontrolled landfill disposal of ash.)

---

(1) "Treatment of Hazardous Waste Leachate," McCardle, J. L., Opatken, E. J., et al, Procedures of the National Conference on Hazardous Wastes and Hazardous Materials, Atlanta, GA, March 4-6, 1986.

GA

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

Pesticide Site Scenario

Because of the reasons presented in the Leachate Site Scenario, use of a CBC to treat leachate by boiling off the water is not an optimum application of the CBC. The use of a CBC to decontaminate soil is, however, a cost-effective approach to that requirement.

The recommended solution to this scenario is the on-site installation using a transportable 36-inch CBC unit which can treat from 40 to 90 tons/day or soil (depending on moisture level, etc.). This is equivalent to 40 to 80 cubic yards/day). The 40,000 cubic yard campaign could be completed in 1-1/2 to 3-1/2 years. A budgetary estimate for soil cleanup is shown on the attached sheet. The effluent from the CBC would be clean flue gas and decontaminated soil, which could be left on the site or landfilled (choice of on-site or type of landfill depends upon site status, metals content, etc.).

Treatment of the leachate is probably best done by flocculation and carbon-filter adsorption, for a combined cost of about $5 per 1,000 gal. The residuals from these process steps could be campaigned through the CBC (segregated because of high arsenic content) and disposed in a controlled landfill. The cost advantage is a minimal quantity of dry material as generated. The CBC unit costs of treating this material would be about the same as for the soil (about $227 cu. yd. equivalent to about $200 ton).

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide Site Scenario @ 40,000 cu. yd.

COMPONENT: Soil Treatment

	Primary Costs	Cost for Site $000	Cost/Unit Volume of Waste $/cu. yd.
1.	Administration	300	8
2.	Equipment	2000	50
3.	Permitting	500	12
4.	Pre-Operational Testing	250	6
5.	Operating Expenses (fuel, treatment additives)	2000	50
6.	Mobilization - Demobilization	750	19
7.	Labor (on-site)	3000	75
8.	Laboratory Analyses	300	8
9.	Volume of Residuals per unit volume of waste	9100	227

1:1

Treatment requirements for residuals

Delisting and return to site.

* Assumes full RCRA.

GA

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

PCB Site Scenario

As in the Leachate and Pesticide Site Scenarios, treatment of the 10,000-20,000 gpd of leachate is best done by traditional methods, with the residuals from such treatment campaigned in an on-site or off-site CBC.

Treatment of the lagoon sludge and site soil is cost-effective in a 36-inch transporable CBC on site. The throughput of the CBC, as with any incinerator, is sensitive to the moisture content of the soil, and means of draining the soil before excavation or during storage prior to combustion would be recommended, (pump off liquid and treat as leachate).* Assuming about 15% moisture in non-dried combined soil-sludge feed, a throughput of about 50 tons/day (40 cu. yds/day) is estimated for a campaign of 2 years. The budgetary cost estimate for this operation is given on the attached sheet. Treatment of the residuals from leachate cleanup would approximate the unit cost of the soil/sludge (about $300/cu. yd. equivalent to about $250/ton).

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* The effect of moisture content in the soil/sludge is shown on the throughput curves in the technical information enclosed with this completed form.

GA

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB Site Scenario

COMPONENT: Sludge and soil (15% H_2O) @ 20,000 cu. yd.

	Primary Costs	Cost for Site ($000)	Cost/Unit Volume of Waste ($/cu. yd.)
1.	Administration	300	15
2.	Equipment	1500	75
3.	Permitting	150	8
4.	Pre-Operational Testing	250	13
5.	Operating Expenses (fuel, treatment additives)	1200	60
6.	Mobilization - Demobilization	750	38
7.	Labor (on-site)	2000	100
8.	Laboratory Analyses	200	10
9.	Volume of Residuals per unit volume of waste	6350	319

1:1

Treatment requirements for residuals

None; return to site.

GA

Scenario

Heavy Metals Site

The Heavy Metals Site is approximately 65 acres in size. Much of the site is of open fields and wooded side hills but at the foot of the hills is a manufacturing building complex. For many years various kinds of dyes were produced and dye waste containing large quantities of mercury were pumped from the buildings to lagoons on higher ground. At times the high level lagoons filled and overflowed sending mercury sludges down the side hill to wetlands adjacent the manufacturing buildings. Over the years, other liquid wastes in addition to the sludge overflows were discharged to the wetlands. As a result, the groundwater at the site has become heavily contaminated.

Remediation of the soil at the site requires removal or on-site treatment of the contaminated soil and the sludge filled lagoons. It has been estimated that approximately 35,000 cubic yards of contaminated soils are contained in the wetlands and that the old lagoons contain approximately 75,000 cubic yards of sludge and soil. Analysis of soil samples generally give the following results:

	ug/g Dry Wgt. Basis				
	Hg	Cd	Cr	Pb	pH
Lagoon sludge and soil	210	0.3	60	52	7.2
Wetlands	2,200	1.6	320	210	6.0

Despite a relatively high seasonal ground water table, the mercury has been found to be only moderately mobile as shown by water samples from monitoring wells.

Concern has been expressed about possible release of vaporous mercury as a result of excavation or turning over the contaminated soils, particularly since the nearby industrial buildings are occupied with businesses that are unable to shut down to accommodate the cleanup.

The second phase of the remediation will concentrate on cleanup of the groundwater. Several monitoring wells have been installed and sampled. Typical analyses for on-site wells are shown below. Monitoring wells are typically a total of 50 ft deep, 30 ft into rock. Pumping tests of the wells yielded about 100 gpm with static levels at about 10 ft. Volume to be treated is approximately 20,000 gpd for five years. Contaminants include:

Vinyl chloride	121 ppb
Benzene	50 ppb
Chromium	10 ppm

Elevated levels of iron and manganese are also present.

Heavy-Metals Site Scenario

The presence of mercury in high concentrations in the site wastes makes necessary a scrubber added to the CBC incinerator because of the volatility of mercury and mercury compounds. The thermal removal of mercury from soil requires a temperature of approximately 600°C. The use of a CBC for removing mercury (and probably also some of the cadmium) is a good choice for this application because of the high soil throughput in a CBC versus other concepts (rotary kiln or moving-bed incinerator.) In all cases, a scrubber train involving a water-spray cooler, potassium permanganate or sodium hypochloride scrubber and sulfur-treated activated charcoal bed filter would be required to remove mercury from the flue gas. The scrubber water may be recycled directly or flocculated with ferrous sulfate or sodium sulfide and passed through an ion-exchange resin before recycle.

Because of the additional unit operations required in this application of a CBC, it may be advisable to dispense with fossil fuels for maintaining the incineration temperature and use, instead, a CBC designed for induction heating. This would significantly reduce the amount of flue gas requiring cooling and scrubbing.

Because of these departures from the standard CBC soil-treatment unit (which does not require a scrubber) we have not made an estimate of the unit cost of soil treatment, rather than to guess that the added unit operations may add about $100-200/cu. yd. to the CBC cost of about $200-300/cu. yd., depending on moisture content. The effluents from this treatment would be bed ash and fly ash from the CBC, which might be disposable in an unregulated landfill depending upon residual heavy metals, and mercury-containing solids from the flue gas cleanup train and cooling-water treatment beds. These would require disposal in a regulated landfill.

J.M.Huber

J. M. Huber Corporation
P. O. Box 2831
Borger, Texas 79008-2831

(806) 274-6331
Telex 73-8458

May 21, 1986

Anthony M. LoRe
Camp Dresser & McKee Inc.
One Center Plaza
Boston, Massachusetts 02108

Dear Mr. LoRe:

Attached is the completed survey questionnaire relating to J. M. Huber Corporation's Advanced Electric Reactor (AER) transportable hazardous waste treatment system. I have also enclosed copies of the formal reports relating to AER demonstrations on PCBs, CCl_4, and TCDD.

If you have any questions regarding this information, please give me a call.

Sincerely,

Jimmy W Boyd

Jimmy W. Boyd, P.E.
Manager Environmental Compliance

pjh

L-59

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company J. M. Huber Corporation

Address P. O. Box 2831

Town Borger State Texas Zip 79008-2831

Contact Person Jimmy W. Boyd Telephone (806) 274-6331

B. Process Characteristics

1. Thermal treatment process available in mobile units. Describe briefly.

The Advanced Electric Reactor (AER) is an electrically heated pyrolytic reactor which rapidly heats wastes falling through it to temperatures of 2100 to 2500°C using intense radiation in the near infrared. Reactants are isolated from the reactor core by a gaseous blanket formed by flowing nitrogen radially inward through the porous core wall. Carbon electrodes are located between the core and the outer vessel. The system can be used to treat gases, liquids, or solids.

2. Process unit(s) that comprise mobile system

Pretreatment System: Solids - crushers, grinders, dryer
Liquids - storage tank & pump,
Reactor - cyclone, caustic scrubber (packed bed), baghouse, activated carbon filters

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s))

Temperature - Up to 2500°C; Residence time - 2 to 10 seconds;

Pressure - slight vacuum to 10 inches of H_2O positive.

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4.

Waste types handled Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations
All organics (including dioxins)	l,s	no restriction	solids - 35 mesh particle size required
PCBs	l,s	"	"
Metals	s	unknown	metals must be mixed with other solids
Chemical warefare agents	l,s	no restriction	

5. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %) CCl_4 DRE >99.9999%; PCB DRE >99.9999%;

Dioxins DRE >99.9999%; Hexachlorobenzone DRE >99.9999%

See attached reports.

6. List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).

Sludges cannot be handled by the AER. A suitable feed system for sludges has not been developed.

7. Give the number of mobile units in operation 1

8. Give the capacity of each unit:

Minimum 3" AER 0.01 lb/min Maximum 3" AER 0.5 lb/min

12" AER 1 lb/min 12" AER 50 lb/min

9. Give the scale of each unit (i.e., pilot, full) both pilot scale

10. Describe any mobile units under construction or development

An engineering design has been completed for a transportable system which will treat 25,000 tons/year of contaminated soils or solids. A 6" AER is presently under construction and should be completed in August, 1986.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, [✓ (4) commercially available in 6-8 months], (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

Demonstrations have been conducted with PCB (TSCA permit received), CCl_4, TCDD (Times Beach, Missouri), and Herbicide Orange (Gulfport Miss.) The system could be made commercially available within 8 to 12 months. Reports are attached. Contact - Jimmy W. Boyd

C. Market Development

1. Your primary market areas Contaminated soils, low BTU liquids, extremely toxic wastes.

2. Company goals for market expansion License technology or provide treatment services.

3. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Almost any type of organic waste on soils and low BTU liquids. A range of volumes can be accommodated.

D. On-Site Utilization

1. Mobilization requirements (time, transport)

6" AER - 1 to 3 days for transport; 2 days for setup

18" AER - 4 to 6 weeks for transport and setup

2. Utility requirements Power - 480 volt, 3-phase, 6" - less than 1 MW demand; 18" - 5 MW demand; water - less than 25 gpm

3. If required utilities are not available at site, can you provide them?

Yes

4. Specify site preparation/space requirements

Site needs to be fairly level

6" - 75' X 100'   18" - 200' X 200'

5. Time/labor requirement to bring unit on-line (including testing)

6" - 4 people, 2 days   18" - 10 people, 4 weeks

6. Number of personnel required for operation 6" - 2 per shift; 18" - 5 per shift

7. Time/labor requirement to dismantle unit 6" - 4 people, 1 day; 18" - 10 people, 3 weeks

8. Equipment decontamination required Baghouse and feed hopper; scraping and steaming or solvent wash. Trailers - steaming

9. What residuals/effluents are produced from your mobile unit?

A solid residue
Scrubber liquid (if a scrubber is required)

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal
Organics on soils	solid residue	none (delistable)	landfill
	scrubber liquid	neutralization	sewer
Organic liquids	solid residue ~~(carbon b~~lack)	none (delistable)	landfill
	scrubber liquid	neutralization	sewer

10. Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

No

11. Specify utility requirements for above electricity

12. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

Huber does not presently supply excavation, waste transportation, residue disposition (i.e., landfill), or analytical services. However, these services can be supplied by subcontractors.

E. Regulatory Requirements

1. Has your unit(s) ever been permitted by federal, state, or local governments? x Yes _____ No.

If so, describe type of permit(s) below.

TSCA (PCBs) - Region VI - EPA

RCRA Part B - Texas Water Commission

2. Do you handle permitting of your unit? X Yes _____ No

3. Average time for approval TSCA 6 to 12 months

RCRA 14 to 24 months

4. Information required of client waste analysis, budget and time constraints, destruction requirements, residue dispostion (on-site or off-site), waste volumes

5. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of Yes

In dealing with RCRA wastes time delays are extensive. Additionally, the delisting system is presently unworkable, since treated residue must still be handled as a hazardous waste.

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value) Volume of waste, site plot plan, waste analysis, site restrictions and accessibility, available utilities, time requirements, personnel protection requirements, decontamination requirements, residue handling

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Exact extent of contamination and quantity of material, site survey and mapping, exact schedule requirements, analytical requirements, permitting constraints. Cost may be elevated by contamination being more wide spread than anticipated or more difficult to remove than envisioned.

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide Site

COMPONENT: Contaminated Soil

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	1,500,000	37.50
2.	Equipment	1,680,000	42.00
3.	Permitting	150,000	3.75
4.	Pre-Operational Testing	150,000	3.75
5.	Operating Expenses (fuel, treatment additives)	2,890,000	72.25
6.	Mobilization - Demobilization	580,000	14.50
7.	Labor (on-site)	3,500,000	87.50
8.	Laboratory Analyses	980,000	24.50
			$\$ 286/\text{yd}^3$

9. Volume of Residuals per unit volume of waste

85%

Treatment requirements for residuals

Neutralization of scrubber liquid.

Solid residue (delisted) to be placed back in original site.

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB Site

COMPONENT: Sand & Gravel Contamination

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	950,000	47.50
2.	Equipment	980,000	49.00
3.	Permitting	150,000	7.50
4.	Pre-Operational Testing	150,000	7.50
5.	Operating Expenses (fuel, treatment additives)	1,470,000	73.50
6.	Mobilization - Demobilization	580,000	29.00
7.	Labor (on-site)	1,998,000	99.90
8.	Laboratory Analyses	580,000	29.00

9. Volume of Residuals per unit volume of waste

53-3/18

85%

Treatment requirements for residuals

Neutralization of scrubber liquid

Solid residue placed back in original site (delisted)

J.M.Huber

Scenario

Heavy Metals Site

The Heavy Metals Site is approximately 65 acres in size. Much of the site is of open fields and wooded side hills but at the foot of the hills is a manufacturing building complex. For many years various kinds of dyes were produced and dye waste containing large quantities of mercury were pumped from the buildings to lagoons on higher ground. At times the high level lagoons filled and overflowed sending mercury sludges down the side hill to wetlands adjacent the manufacturing buildings. Over the years, other liquid wastes in addition to the sludge overflows were discharged to the wetlands. As a result, the groundwater at the site has become heavily contaminated.

Remediation of the soil at the site requires removal or on-site treatment of the contaminated soil and the sludge filled lagoons. It has been estimated that approximately 35,000 cubic yards of contaminated soils are contained in the wetlands and that the old lagoons contain approximately 75,000 cubic yards of sludge and soil. Analysis of soil samples generally give the following results:

	ug/g Dry Wgt. Basis				
	Hg	Cd	Cr	Pb	pH
Lagoon sludge and soil	210	0.3	60	52	7.2
Wetlands	2,200	1.6	320	210	6.0

Despite a relatively high seasonal ground water table, the mercury has been found to be only moderately mobile as shown by water samples from monitoring wells.

Concern has been expressed about possible release of vaporous mercury as a result of excavation or turning over the contaminated soils, particularly since the nearby industrial buildings are occupied with businesses that are unable to shut down to accommodate the cleanup.

The second phase of the remediation will concentrate on cleanup of the groundwater. Several monitoring wells have been installed and sampled. Typical analyses for on-site wells are shown below. Monitoring wells are typically a total of 50 ft deep, 30 ft into rock. Pumping tests of the wells yielded about 100 gpm with static levels at about 10 ft. Volume to be treated is approximately 20,000 gpd for five years. Contaminants include:

Vinyl chloride	121 ppb
Benzene	50 ppb
Chromium	10 ppm

Elevated levels of iron and manganese are also present.

J.M. Huber

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Heavy Metals

COMPONENT: Soil - under the assumption fears can be allayed regarding excavation

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration	2,750,000	25.00
2.	Equipment	3,135,000	28.50
3.	Permitting	150,000	1.35
4.	Pre-Operational Testing	150,000	1.35
5.	Operating Expenses (fuel, treatment additives)	7,500,000	68.25
6.	Mobilization - Demobilization	580,000	5.25
7.	Labor (on-site)	7,700,000	70.00
8.	Laboratory Analyses	2,365,000	21.50

$\$222/\text{yd}^3$

9. Volume of Residuals per unit volume of waste

85%

Treatment requirements for residuals

Metals will be concentrated in baghouse residue.

They can then be refined or landfilled as necessary.

Modar

MODAR

MODAR, INC.
3200 WILCREST, SUITE 220
HOUSTON, TEXAS 77042
(713) 785-5615

May 8, 1986

Mr. Anthony M. LoRe
Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108

Dear Mr. LoRe,

Attached please find the completed process survey which was forwarded to us on April 4. We have answered it as completely as we are able, since some of the questions are not applicable to our process.

Very truly yours,

Fred A. Sieber

FAS/dh
Enclosure(s)

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company MODAR, Inc.

Address 3200 Wilcrest, Suite 220

Town Houston State Texas Zip 77042

Contact Person Fred A. Sieber, President Telephone (713) 785-5615

B. Process Characteristics

1. Thermal treatment process available in mobile units. Describe briefly.

Oxidation of organic waste in a water medium above critical point. Inorganic salts are insoluble at oxidation conditions and are removed separately. products are H_2O, CO_2, and inorganic salts.

2. Process unit(s) that comprise ~~mobile~~ Transportable system Skid mounted components: Maximum width - 8ft; Maximum length - 30ft. Additionally for units handling in excess of 10,000 gal/day aqueous waste the reactor/salt separator would be mounted on a concrete foundation. Storage tanks for the waste would be separate from the process plant.

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s))

600°C, 250 atm, residence time less than 1 minute.

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4. Waste types handled

Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations
All organics	Liq.	1-100% in water	
(i.e. oils,			
solvents,			
pesticides,			
PCB's,Dioxins)			

5. Data on destruction/removal efficiencies of your ~~mobile~~ Transportable treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %)

Dioxin DRE 99.9999%.

Trichloroethylene 99.9999%

Testing work has primarily centered on dilute wastes rather than more concentrated materials. Therefore DRE has not normally been calculated except whre requested by specific client

6. List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).

Waste must be pumpable.

7. Give the number of ~~mobile~~ Transportable units in operation 1

8. Give the capacity of each unit:

Minimum None if all heating value is supplied by fuel- economic minimum -1% Maximum 30 gal/day of organic material in an aqueous waste containing 0-100% organic.

9. Give the scale of each unit (i.e., pilot, full) Pilot

10. Describe any ~~mobile~~ Transportable units under construction or development

The first commercial scale system is currently being designed. It can be transported but the intent is that the plant be site specific. It's capacity will be 10,000 to 30,000 ga./day of aqueous waste containing 10 wt% organics. construction is expected to be complete within 18 months.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, [✓ (5) commercially available now.] If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

C. Market Development

1. Your primary market areas Aqueous waste containing 1-30% organic. Highly toxic wastes from less than 1% to 100% organic.
2. Company goals for market expansion

Organic Sludges.

3. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Waste up to 100% organic. If the waste is less than 10% organic, volume should be 5,000-30,000 gal/day total waste. If the waste is greater than 10% organic, total waste should be such that organic throughput is 500-3,000 gal/day. These volumes are based on currently available unti capacities.

D. On-Site Utilization

1. Mobilization requirements (time, transport) 3-4 months, including preparation, transport, set up, and start up for pilot plant.

2. Utility requirements Electricity - 480V; cooling water, instrument supply air.

3. If required utilities are not available at site, can you provide them?
We can only provide instrument air compression. Site must provide water and electricity.

4. Specify site preparation/space requirements 50 ft x 150 ft concrete pad for 10,000 to 30,000 gpd process unit.

5. Time/labor requirement to bring unit on-line (including testing)
4-6 weeks, 6-8 man crew - 8 hour day

6. Number of personnel required for operation 2 per shift for 24 hr./day operation.

7. Time/labor requirement to dismantle unit 4 weeks.

8. Equipment decontamination required Solvent washing of feed storage and pumping module.

9. What residuals/effluents are produced from your mobile unit?
Liquid - H_2O
Gas - CO_2, O_2 (excess of stoichiometric) *

* Pilot plant uses air rather than liquid oxygen as source of oxidant. Therefore, gaseous effluent consists of CO_2 N_2 and excess air.

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal
Aqueous Organic	H_2O		Discharge
	O_2, CO_2		Discharge
	Salts		Resource recovery or
			Land disposal of solids or brine.

10. Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

No.

11. Specify utility requirements for above

12. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) MODAR would only provide the process plant and a technical coordinator plus training for operators. All services must be supplied by others.

E. Regulatory Requirements

1. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ____ No.

If so, describe type of permit(s) below. New York State permit for demonstration, using pilot plant, at CECOS International, Niagara Falls, NY. EPA approved for same.

2. Do you handle permitting of your unit? * Yes ____ No

3. Average time for approval 1 year.

* In cooperation with site owner.

4. Information required of client RCRA Part B permit application information.

5. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of Yes. Because there were few regulations established for innovative technologies the permitting process required extensive new definitions of requirements.

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value)

BTU value, organic halogen concentrations, inorganic salt concentration, waste volume, site utilities.

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Site Labor - Isolated site will require more labor (for safety reasons) than the site with current labor base.

Credit for energy recovery (by-product steam can reduce net treatment costs.)

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years. Yes

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb). No

Scenario
Leachate Site

This site has a leachate source that has been capped but a maximum volume of about 2,000 gpd is currently being generated. It is anticipated that the cap will be effective in reducing the volume of leachate over a period of years. The leachate is pumped from wells or sumps into a central collection system and ultimately to a storage tank.

Yes

Analysis of the leachate is shown below. It is proposed to treat the leachate so that it can be trucked to a publicly owned wastewater treatment facility. The standards to be met are shown below.

TABLE 1

LEACHATE CHARACTERISTICS AND DISCHARGE LIMITATIONS

Concentrations are in micrograms per liter (ug/l), unless otherwise stated

Parameter	Leachate Data Average	 High	Pollutant Limitation for Discharge to WWTP (1)
pH	5.84	5.65 (low)	5.5 - 9.5
Specific Conductance	10,400 (umhos/cm)	8,700 (low)	-
Total Suspended Solids (TSS)	427 (mg/l)	530 (mg/l)	300 (mg/l)
Total Dissolved Solids (TDS)	8,959 (mg/l)	13,600 (mg/l)	-
Total Volatile Solids (TVS)	4,010 (mg/l)	5,960 (mg/l)	-
Alkalinity	4,750 (mg/l)	5,200 (mg/l)	-
BOD	>505 (mg/l)	>770 (mg/l)	250 (mg/l)
Total Kjeldahl N.	114.5 (mg/l)	148 (mg/l)	-
Sulfate	280 (mg/l)	520 (mg/l)	250 (mg/l)
Lead	231	900	690
Nickel	682	7,200	3,980
Iron	439,000	817,000	
Zinc	1,764	10,000	2,610
VOA	37,578	112,144	
B/N	13,716	19,534	
Pesticides	0.9	0.12	
Total Toxic Organics	51,394	131,728	<2,130 (2)

---

(1) Pollutant limitations are based on pretreatment requirements specified by WWTP.
(2) Only Total Toxic Organics (TTO) must be less than 2,130 ug/l.
BDL = Below Detectable Limits

Cost of Treatment

The cost of treatment cannot be expressed to the detail shown on your analysis sheet since MODAR does not sell hardware nor act as a service contractor. Rather, MODAR leases the Treatment Unit to the client and charges a "throughput fee" which could vary greatly depending upon the size of the unit and the length of time a transportable unit remained at the client's location.

As a generalization, overall operating costs for the pesticide site to run from \$0.50 to \$0.75/gal based upon 20,000 gpd for five years.

The leachate site overall costs might vary from \$1.40 to \$2.00/gal. Labor to operate the unit if allocated to only this small unit would tend to cause the higher estimate to be more probable.

Shirco

Shirco Infrared Systems
Incorporated

214 630-7511

April 18, 1986

Mr. Anthony M. Lore
Camp Dresser & McKee, Inc.
One Center Plaza
Boston, MA 02108

Dear Mr. Lore:

Enclosed please find the completed survey questionnaire which details the status and capabilities of Shirco Infrared Systems' mobile incineration technology.

Our first Portable Pilot incinerator was introduced in November 1984 and has since completed several on-site incineration tests of hazardous materials including a dioxin-contaminated soils burn at Times Beach and a dioxin/creosote/pentachlorophenol-contaminated soils burn for International Paper. An on-site PCB burn is scheduled for May 1986 in Florida.

Full-scale mobile systems with a nominal capacity of 100 tons/day are currently under construction. The first unit is scheduled for completion in July 1986 with two additional units to follow in August and September. Additional details of the systems are included in the enclosed questionnaire.

I wish you luck with your questionnaire, as I know how difficult it can be to obtain a comprehensive response. Please let me know if you have any questions or require additional information.

Sincerely,

George H Hay

George H. Hay
Products Manager,
Mobile Systems

GHH/sc

enclosures

1195 Empire Central Dallas Texas 75247-4301

Shirco

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company Shirco Infrared Systems Inc.

Address 1195 Empire Central

Town Dallas State TX Zip 75247

Contact Person Mr. Scott Berdine or Mr. George H. Hay Telephone 214-630-7511

B. Process Characteristics

1. Thermal treatment process available in mobile units. Describe briefly.

The present system consists of a 100 lb/hr demonstration unit housed in a 45' trailer van. System is comprised of an infrared electric belt furnace consisting of a feed system, primary chamber, gas/or infrared secondary chamber, off gas handling system, data acquisition and control equipment. Full-scale units with nominal capacities of 100 tons/day currently under construction.

2. Process unit(s) that comprise mobile system

SEE ATTACHMENT

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s)) Both the demonstration and full-scale systems include a primary chamber, process temperature range from 500° to 1850°Fwith a residence time of 10-180 minutes. Oxidizing, reducing, or neutral atmospheres can be provided. The secondary chamber has a process range of between 1,000 and 2300°F and 2.2 seconds residence time.

SECTION A

Item 2. Process unit)s) that comprise mobile system:

The demonstration unit primary chamber is 2½ feet wide by 9 feet long by 7 feet high, weighing 3000 pounds. The secondary chamber is 3 feet wide by 9 feet long by 3 feet high weighing 1500 pounds. Exhaust gases vent thru a venturi scrubber with a sump tank.

The full-scale system will consist of a 9x9x61' primary chamber, a 9x9x70' secondary chamber, venturi scrubber and packed bed absorber, and associated instrumentation and controls. The process functions are identical to those of the demonstration unit. The system is delivered to the site in the following manner:

Primary Chamber: Single flat bed trailer

Secondary Chamber: Two (2) flat bed trailers

Scrubber: Single flat bed trailer

Control Room: Single van trailer

Ancillaries: Two (2) flat bed trailers

Preceding page blank

4.

Waste types handled Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations
PCB contaminants	solid/ sludge/ soil	0-1 million ppm	none
Organic contaminants	solid/ sludge/ soil	0-1 million ppm	none
Mixed (organic/ inorganic) contaminants	solids/ sludge/ soil	0-1 million ppm	none
Explosive Contaminants	solids/ sludges/ soils	0-1 thousand ppm	none

5. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %) Acenapthene, anthracene, carbazole, chrysene, dibenzothiophene, flouranthene, fluorene, pentachlorophenol, phenanthrene, pyrene, TCDD - DRE's for all compounds >99.9999%

6. List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).
Wastes must be at least 22% solids prior to feed; particle sizes must be controlled in order to allow discharge into feed system -- nominally not larger than 1-1½" in diameter

7. Give the number of mobile units in operation 1

8. **Give the capacity of each unit:**

Minimum Demo 5.5 lb. soils, sludges, solids
Full 10 tons per day

Maximum Demo 100 lbs. per hour soils, sludges, solids.
Full up to 200 tons per day

9. **Give the scale of each unit (i.e., pilot, full)** Demonstration unit with linear scale-up to to full scale unit; full scale unit presently under construction.

10. **Describe any mobile units under construction or development**

Two additional demonstration units are under design/construction -- due in June 1986. Two full-scale (up to or greater than 100 tons per day) units are under construction -- due in August 1986.

11. **Mobile technology status (circle one) (1) R&D, (2) pilot, [✓ (3) demo], [✓ (4) commercially available in 6-8 months], (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.**

Please see attached economic operating estimate for full-scale unit.

C. **Market Development**

1. **Your primary market areas** On-site incineration contractors/PRP's

2. **Company goals for market expansion** In-plant, in-process treatment equipment; carbon regeneration and activation; and, pyrolytic recovery systems.

Also liquid incineration systems.

3. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Any site with organic contaminated soils, solids or sludges and any applications benefiting from volume reduction or carbon regeneration.

D. On-Site Utilization

1. Mobilization requirements (time, transport) Demo - 3 days to transport, one day startup, trial duration, 2 days - decontamination and transport off-site. Full scale - 10 days delivery - two weeks startup - remediation. - One week decontamination, dismantle and transport off-site.
2. Utility requirements Demonstration unit - 30 KVA/480 volt; 15 amp/120 volt and 150 SCFH gas/propane and 20 gpm water. Full-scale -1500 KVA/480 volt and 15 amp/120 volt. Up to 5.7 MM BTU/hr for afterburner. Up to 100 gpm water for scrubber and afterburner cooling.
3. If required utilities are not available at site, can you provide them?

Yes - at additional costs.

4. Specify site preparation/space requirements (Full-scale) level grade, access roads, 80' by 40' (10 lbs/inch^2) concrete pads.
5. Time/labor requirement to bring unit on-line (including testing)

Demo unit - 4 people - 3 days (including delivery). Full-scale - 8 people - 3 weeks including delivery.

6. Number of personnel required for operation Demonstration - 2, Full - 12 (24 hour operation).
7. Time/labor requirement to dismantle unit Demo unit - 2 days; Full-scale unit- one week.
8. Equipment decontamination required

Steam clean feed and ash collection system; bake-out incineration system.

9. What residuals/effluents are produced from your mobile unit?

See Next Page

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal
Soils, sludges,	delistable	none	land disposal
solids	ash & sand		
	scrubber blowdown	none	blend with ash

10. Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

NO

11. Specify utility requirements for above Same as for demonstration unit or full-scale unit.

12. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) Excavation, materials handling, lab analyses and residuals disposal (unless contracted for).

E. Regulatory Requirements

1. Has your unit(s) ever been permitted by federal, state, or local governments? _X_ Yes ___ No.

If so, describe type of permit(s) below. Trial demonstrations under Part A permit

2. Do you handle permitting of your unit? _X_ Yes ___ No

3. Average time for approval Interim status - 2 weeks; RCRA part B - 4 months; on-site PCB - 45 days; National PCB - 8 months; dioxin certification - 8 months. Any air or water permit not greater than 3 months.

4. Information required of client See attached sheet for information required. If client wants detailed economic data, then test trials are required.

5. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of Permitting is expected to be a major cause of delay in some but not all cases. Negative public reaction is the only uncertain issue, particularly for on-site operation of the unit.

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value) (Please see attached sheet sections 2 and 3). Otherwise, utilities, grade, access, and a profile of the contaminated materils reflecting moisture, BTU content, and particle size - sizes throughout the site.

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Demonstration trials actually testing a sufficient number of waste samples from the site in question.

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB Site

COMPONENT: 24,000 cubic yards contaminated soils and sludges

	Primary Costs (1)	(2) Cost for Site	(3) Cost/Unit Volume of Waste
1.	Administration		15.00
2.	Equipment		40.00
3.	Permitting	80	3.50
4.	Pre-Operational Testing	Not	Required
5.	Operating Expenses (fuel, treatment additives)		30.00
6.	Mobilization - Demobilization	60	2.50
7.	Labor (on-site)		15.00
8.	Laboratory Analyses	200	8.00

9. Volume of Residuals per unit volume of waste $114/yd^3

0.6 - 0.8

Treatment requirements for residuals None

(1) Battery limit costs of incineration - waste feed to incinerator ash hoppers.

(2) Site costs in $000

(3) Unit costs in $/cubic yard

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

Shirco

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide Site

COMPONENT: 40,000 cubic yards contaminated soils

	Primary Costs (1)	(2) Cost for Site	(3) Cost/Unit Volume of Waste
1.	Administration		15.00
2.	Equipment		30.00
3.	Permitting	120	3.00
4.	Pre-Operational Testing	60	1.50
5.	Operating Expenses (fuel, treatment additives)		40.00
6.	Mobilization - Demobilization	60	1.50
7.	Labor (on-site)		15.00
8.	Laboratory Analyses	400	10.00

9. Volume of Residuals per unit volume of waste

0.8 - 0.9

Treatment requirements for residuals None

(1) Battery Limit costs of incineration - waste feed to incinerator ash hoppers

(2) Site costs in $000

(3) Unit costs in $/cubic yard

```
                    ON-SITE MOBILE INCINERATION SERVICE
                        ESTIMATED ECONOMIC MODEL
                              January 1986

Equipment = One Shirco Mobile Furnace System  9 x 61  with related ancillaries

Effective Thruput    30,100 tons in         43 weeks/yr      @         100 tons/day

                 At   82.69%  Utilization

Operating Expense:

Personnel                12 Men - 3 Shifts -           7 days/wk
   Wage Rate         $12.00 per hr =   $24,960 per yr average rate              $/TON
   Overhead Rate      40.00% of Direct Wage Rate                              ==========

                          Total Labor         $419,328  Per Year                 13.93

Site Expenses:
   Pit & Transfer       $125   per day                   37,625                   1.25
   Chemical Cost       $0.90   per ton                   27,090                   0.90
   Energy Cost        $33.07   per ton  (max)           995,407                  33.07
   Ash Disposal                              >                0                   0.00
   Scrubber Effluent                         >                0                   0.00
   Cooling Water                                         27,090                   0.90
   Spare Parts                                           80,000                   2.66
   Maintenance         $1.40   per ton                   42,140                   1.40
   Monthly Oper Costs
     Compliance, Te    $1.93   per ton                   58,093                   1.93
     Fuel              $1.68   per ton                   50,568                   1.68
     Oper Ovhd       $18,813   per mo                   225,750                   7.50

   Permitting Assistance - OSIS                         120,000                   3.99
   Relocation, Transport                                 60,000                   1.99

   Insurance                                            110,000                   3.65

   Misc Contingency            15.00%                   337,964                  11.23
                                                     -----------              ----------
          TOTAL OPERATING COSTS                      $2,591,055    DIRECT COST/TON  $86.08

Equipment Cost Estimate:
   Shirco Mobile System       9 x 61                  2,500,000
     + Instrumentation, Control Van
   Generators, Feed Prep Equip        (Est)             150,000
   Field Facilities                   (Est)             100,000
                                                     -----------
       TOTAL EQUIPMENT COST                           2,750,000

          EQUIPMENT COST PER TON      For Payback  in  -      36 months          $30.45
                                                                              -----------

                TOTAL COST PER TON Before PROFIT,INTEREST and TAXES           $116.54
                                                                              ===========
```

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company WASTE-TECH SERVICES, INC.

Address 18400 WEST 15TH AVE.

Town GOLDEN **State** CO. **Zip** 80401

Contact Person MR. ELIOT COOPER **Telephone** (303)-279-9712

B. Process Characteristics

1. Thermal treatment process available in mobile units. Describe briefly.

FLUIDIZED BED WITH CONTINUOUS BED LETDOWN

2. Process unit(s) that comprise mobile system 1. FLUIDIZED BED

2. SECONDARY REACTION CHAMBER (SRC) 3. OFFGAS TREATMENT

Offgas treatment units are waste specific. May include ionizing wet scrubber, venturi scrubber, packed scrubber or baghouse.*

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s))

TEMPERATURE - 950°C to 1300°C

RESIDENCE TIME - BED - 1 MINUTE

SRC - 3 SECONDS

BED HEIGHT - 2 FEET (operation)

- 1 FOOT (at rest)*

---

*Additional information provided in followup contact

Preceding page blank

4.

Waste types handled Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations
Chlorinated Organics	ALL	100%	High Sodium, Fluorinated
- Carbon tet			Compounds
- Pentachlorophenol			

5. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %)

Carbon tetrachloride > 99.99% DE

6. List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).

Heavy metals with resulting significant air Quality Impact

Size reduction necessary for non-uniform sized solids*

7. Give the number of mobile units in operation One

---

*Additional information provided in followup contact

8. Give the capacity of each unit:

Minimum 1.5 MM BTU/HR Maximum

9. Give the scale of each unit (i.e., pilot, full) Demonstration scale

10. Describe any mobile units under construction or development

One - Under Construction 20 MM BTU/HR

One - Under Development 40 MM BTU/HR

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, (5) commercially available now. If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

20-40 MM BTU/HR UNITS AVAILABLE WHEN CONTRACTS ARE SIGNED.

WE WILL BUILD UNITS WHEN NEEDED AND WILL NOT BUILD WITHOUT CONTRACTS.

C. Market Development

1. Your primary market areas ENTIRE U.S.

2. Company goals for market expansion NONE

3. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Surface Impoundment Closure

Landfill Closure

Contaminated Soil

D. On-Site Utilization

1. Mobilization requirements (time, transport) 1 week

2. Utility requirements Normal power hookups

Water 15-200 gpm

3. If required utilities are not available at site, can you provide them?

Yes

4. Specify site preparation/space requirements 100' x 100' level surface

5. Time/labor requirement to bring unit on-line (including testing) 3 weeks

6. Number of personnel required for operation 2-3

7. Time/labor requirement to dismantle unit 1 day

8. Equipment decontamination required Steam Cleaner

9. What residuals/effluents are produced from your mobile unit?

Ash
Wastewater

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal
ASH		STABILIZATION (METALS)	LANDFILL
WASTEWATER		TSS, TDS	DISCHARGE
			EVAPORATION POND
			DEEP WELL

10. Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

NO

11. Specify utility requirements for above

12. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues) ALL OF THESE PLUS ON-SITE WASTE ANALYSIS

E. Regulatory Requirements

1. Has your unit(s) ever been permitted by federal, state, or local governments? ____ Yes X No. PERMITS PENDING

If so, describe type of permit(s) below.

2. Do you handle permitting of your unit? X Yes ____ No

3. Average time for approval 3 MONTHS TO ONE YEAR

4. Information required of client WASTE ANALYSIS

CORRECTIVE ACTIONS

5. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of CAN BE

OWNER/OPERATOR ISSUES

CORRECTIVE ACTION DELAYS

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value)

WE USE A DETAILED 6 PAGE FORM AND THIS INFORMATION IS USED IN A

COMPUTER PROGRAM TO GENERATE THROUGHPUTS.

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

% CHLORINE

% WATER

% ASH

WASTE VOLUMES

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

Waste-Tech

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PESTICIDES

COMPONENT: TANKS/SOILS

Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals TSS-WASTE WATER

At this time, we are not ready to give cost information since we need much more information to estimate cost. We did bid on the ACME solvents cleanup (Rockford, IL) and the complete project cost was about $12 million. Commercial incineration costs today are:

50 - 80¢/lb - sludges/solids

30¢/lb - liquids

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB SITE

COMPONENT: LAGOONS/SOILS

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration		
2.	Equipment		
3.	Permitting		
4.	Pre-Operational Testing		
5.	Operating Expenses (fuel, treatment additives)		
6.	Mobilization - Demobilization		
	(Local - 100 miles)		
	(Non-local - 1000 miles)		
7.	Labor (on-site)		
8.	Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals TSS + TDS Wastewater

Winston Technology

Winston Technology, Inc.

May 23, 1986

Mr. Colin W. Baker
Camp Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108

Re: Winston Technology Mobile Incinerator

Dear Mr. Baker:

Thank you for your letter of May 16, 1986. We are returning herewith your survey, completed in all aspects as fully as possible, with the exception of the Costing scenarios. We would be able to include a price for a specific site once full information and site specifics is provided, enabling us to answer your costing survey in a businesslike and efficient manner.

Thank you for the opportunity to participate in this survey and we would be willing to cooperate or provide any further information you may require.

Very truly yours,

Patrick A. Phillips

Patrick A. Phillips

Enclosure

848 N. Cleveland-Massillon Rd.
Akron, Ohio 44313
Phone: (216) 666-8080
Telex 812 759

6920 N.W. 44th Ct.
Lauderhill, Florida 33319
Phone: (305) 748-1769

One Byram Brook Place
Armonk, New York 10504
Phone: (914) 273-6533
Telex 880 388

6-19

Winston Technology

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company Winston Technology, Inc.

Address 6920 N.W. 44th Ct.

Town Lauderhill **State** Fla. **Zip** 33319

Contact Person Patrick A. Phillips **Telephone** (305)-748-1769

B. Process Characteristics

1. Thermal treatment process available in mobile units. Describe briefly.

2 x 8,000,000 BTU/HR.

1 x 35,000,000 BTU/HR. (under construction)

ALL UNITS ARE ROTARY KILN WITH AFTERBURNER

2. Process unit(s) that comprise mobile system

8,000,000 BTU/HR UNIT MOUNTED ON ONE TRAILER.

35,000,000 BTU/HR UNIT MOUNTED ON THREE TRAILERS.

ALL UNITS HAVE ADDITIONAL CONTROL UNIT FOR COMPUTER.

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s))

MAX TEMP. 2800°F.

2.5 SECONDS RESIDENCE IN AFTERBURNER

TOTAL SYSTEM UNDER 0.5 INCHES NEGATIVE PRESSURE

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6-91

4\.

Waste types handled Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations
P.C.B.;s.	ALL	NO LIMIT	FEED RATE ACCORDING TO CONCENTRATION
VOLATILE ORG.	ALL	NO LIMIT	" "
METALS	ALL	NO LIMIT	" "

5. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %)

PCB DRE > 99.9999%.

6. List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).

HIGH WATER CONTENT OF WASTE

7. Give the number of mobile units in operation TWO

8. Give the capacity of each unit:

Minimum DEPENDENT UPON WASTE ANALYSIS

Maximum DEPENDENT UPON WASTE ANALYSIS

9. Give the scale of each unit (i.e., pilot, full) FULL.

10. Describe any mobile units under construction or development

35,000,000 BTU/HR THREE TRAILER MOBILE ROTARY KILN UNIT UNDER CONSTRUCTION.

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, [✓ (5) commercially available now.] If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

8,000,000 BTU/HR UNIT AVAILABLE NOW.

AWAITING SITE TO CONDUCT TEST BURN FOR E.P.A.

C. Market Development

1. Your primary market areas SUPERFUND SITES, CHEMICAL WASTE PLANTS.

2. Company goals for market expansion ADDITIONAL 2-3 UNITS PER YEAR, ACCORDING TO MARKET REQUIREMENTS.

3. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

POHC'S LIST MATERIALS ANY TYPE.

D. On-Site Utilization

1. Mobilization requirements (time, transport)

48 HRS. MOBILIZATION ON SITE

350 MILES PER DAY TRANSPORTATION

2. Utility requirements ELECTRICAL - 3 PH. 440V.

WATER SUPPLY FOR SCRUBBERS.

FUEL

3. If required utilities are not available at site, can you provide them?

YES

4. Specify site preparation/space requirements

100 FT X 100 FT. CEMENT OR OTHER FIRM BASE

SUITABLE FOR CONTAINING ANY POTENTIAL SPILLAGE.

5. Time/labor requirement to bring unit on-line (including testing)

48 HRS - 3 PERSONNEL - TESTING AS REQUIRED BY E.P.A.

6. Number of personnel required for operation TWO PER SHIFT.

7. Time/labor requirement to dismantle unit 72 HRS. - 3 PERSONNEL

8. Equipment decontamination required

ACCORDING TO WASTE ANALYSIS, MAY REQUIRE SOLVENT STEAM CLEANING.

9. What residuals/effluents are produced from your mobile unit?

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal
SOIL	SOIL	ANALYSIS	SANITARY LANDFILL.
SLUDGE	INORGANICS	"	" "
LIQUID	"	"	" "

10. Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

NO

11. Specify utility requirements for above NONE

12. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

NO EXCAVATION SERVICE

TRANSPORT TO UNIT CAN BE PROVIDED.

RESIDUE DISPOSAL CAN BE PROVIDED.

E. Regulatory Requirements

1. Has your unit(s) ever been permitted by federal, state, or local governments? Yes [✓ No.]

If so, describe type of permit(s) below. NONE

2. Do you handle permitting of your unit? [✓ Yes] No

3. Average time for approval DEPENDENT UPON AUTHORITIES.

4. Information required of client ANALYSIS, TYPE, BTU CONTENT, VOLUME.

5. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

YES

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value)

BTU'S. - ANALYSIS-CHLORINE CONTENT - WATER.

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

PCB CONTENT.

CHLORINE

WATER

HIGH CLAY SOILS.

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Winston Technology

SCENARIO

Pesticide Site

The Pesticide Site is the site of a chemical plant currently abandoned but which operated over a period of 50 years producing pesticides, herbicides, floor waxes and polishes. The buildings have fallen into disrepair and an IRM has been issued to demolish the buildings and an adjoining tank farm containing 32 tanks ranging in size from 5,000 to 12,000 gal. Tank residues have been sampled; analysis reveals quantities of DDT, 2-4,D and 2-4-5,T.

Groundwater at the site is heavily contaminated with compounds such as tetrachlorethylene (2,700 mg/kg), xylenes (20,000 mg/kg), chlordane (190 mg/kg) and arsenic (500 mg/kg). It is proposed to pump and treat. Withdrawal wells have been installed and are fitted with 50 gpm submersible pumps. Volume is estimated at 20,000 gpd for 5 years.

Soil at the site and on the land surrounding the site shows evidence of contamination. Approximately 20 acres of land is involved with an estimated 40,000 c.y. showing contamination with pesticides including chlordane (up to 219,000 ppb) and DDT (up to 525,800 ppb).

Winston Technology

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PESTICIDE,

COMPONENT: CHEMICALS.

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration		
2.	Equipment		
3.	Permitting		
4.	Pre-Operational Testing		
5.	Operating Expenses (fuel, treatment additives)		
6.	Mobilization - Demobilization		
	(Local - 100 miles)		
	(Non-local - 1000 miles)		
7.	Labor (on-site)		
8.	Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

SOIL CHARGED = 100% WASTE

Treatment requirements for residuals

ANALYSIS FOR DE-LISTING.

Scenario

PCB Site

The PCB Site is located in a rural area of New England. Roads are narrow, but suitable for truck traffic. The 6 acre site provides separate access and egress roadways constructed of crushed stone. The 15,000 sq ft staging area provides both telephone and 220 volt electric service.

The waste material is contained in 4 small contiguous lagoons with a total surface area of 11,000 sq ft (140 ft x 80 ft). A maximum depth of 10 feet is estimated for a total volume of 4,000 cubic yards. The material is predominately sludge with the consistency of toothpaste which makes the handling of this waste very difficult. The PCB contaminated (10,000 ppm) material also has a BTU value in the 5,000-10,000 range with a flash point below 100°F. The site soils consisting of sand and fine gravel are also contaminated with PCBs in the 50-500 ppm range. It is estimated that a total volume of approximately 20,000 cubic yards of soil is contaminated to a depth of 15 feet in an area with a groundwater depth of 7 feet.

Volatile organic groundwater contaminants in the area are benzene, toluene and TCE in the 40 ppm range. It is anticipated that a pump and treat system of 10,000-20,000 gpd for five years will be required.

Winston Technology

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: PCB

COMPONENT: ______

Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

SOILS = 100% RESIDUAL

Treatment requirements for residuals ______

ANALYSIS FOR DE-LISTING.

6-1-0

Zimpro

ENVIRONMENTAL & ENERGY SYSTEMS

May 28, 1986

Camp, Dresser & McKee Inc.
One Center Plaza
Boston, MA 02108

Attention: Mr. Frank C. Sapienza

Reference: Mobile Treatment System

Gentlemen:

We are pleased to enclose herewith a copy of the two survey forms completed for both our thermal and biological mobile processes. They are wet air oxidation (thermal) and powdered activated carbon technology (bio-physical). Our compliments on the comprehensiveness of the survey, but we are somewhat disappointed that our wet air oxidation system had no application to the scenarios presented with the survey. It is a viable process as evidenced by its commercial operation in Casmalia, CA (bulletin attached). Do you have other scenarios we can respond to? Please advise.

Good luck in the swift completion of your EPA project!!

Very truly yours,

ZIMPRO INC.

J. Robert Nicholson
Marketing-Sales

JRN/cb

cc: F. Mahony

enclosures

MILITARY ROAD
ROTHSCHILD, WISCONSIN 54474

6-281

SUPERFUND SITE
MOBILE TREATMENT UNITS
THERMAL PROCESS SURVEY

A. General

Company Zimpro Inc.

Address Military Road

Town Rothschild State Wisconsin Zip 54474

Contact Person J. Robert Nicholson Telephone 1/800-826-1476
715/359-7211

B. Process Characteristics

1. Thermal treatment process available in mobile units. Describe briefly.

Wet air oxidation - Process destroys organic materials which are dissolved or suspended in liquid. This a true oxidation is without flame in a totally enclosed system, which converts organics to simplier forms which are biodegradable, or the process can completely oxidize to CO_2 and water.

2. Process unit(s) that comprise mobile system heat exchangers, reactor, gas-liquid separator, air compressor, positive displacement pump, gas-carbon adsorption and pressure reducing system.

3. System operating parameters (i.e., temperature, residence time, pressure, etc. of the combustion chamber(s)/reactor(s))

450-550-600°F; 1500-2500 psig; 1-2 hours residence time.

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4. Waste types handled

Give examples (i.e., volatile organics, PCBs, metals, etc.)	Form (liquid, solid, sludge, soil)	Concentration Range	Restrictions or Limitations

Inorganic/organic cyanides, aliphatic/aromatic hydrocarbons, halogenated organics, phenols, sulfides, mercaptans, pesticides, herbicides, scrubbing liquors, clean-up residues, organic sludges and still bottoms.

All above in liquid form with COD concentrations from 10 to 200 grams/liter.

5. Data on destruction/removal efficiencies of your mobile treatment unit for particular chemical compounds would be very useful to clean-up site managers. Please provide available DRE data for particular compounds (e.g., PCB DRE > 99.9999 %)

COD reduction: 85-90%; All compounds in 4) above 95-99% destroyed along with 100% of toxicity.

6. List any specific site and/or waste characteristics (i.e., quantity, form) that may prevent effective utilization of the company's mobil unit(s).

None

7. Give the number of mobile units in operation Three @ 10 gpm nominal capacity

8. Give the capacity of each unit:

Minimum 5 gpm Maximum 13 gpm

The design of all three units in 7) above is 10 gpm.

9. Give the scale of each unit (i.e., pilot, full) Full scale

10. Describe any mobile units under construction or development

A. Development complete on 10 gpm with none under construction (5/1/86)

B. Development underway on 2.0 gpm unit

11. Mobile technology status (circle one) (1) R&D, (2) pilot, (3) demo, (4) commercially available in 6-8 months, [✓ (5) commercially available now.] If available now, please provide detailed utilization history (separate sheet or article) with cost and performance evaluation. If it will be available soon, provide status report and/or name of technical staff to contact for follow-up.

Contact: J. Robert Nicholson 1/800-826-1476

C. Market Development

1. Your primary market areas Commercial treaters, HW generators

2. Company goals for market expansion Deep-well injectors as pre-treatment

[illegible]

3. The EPA is currently assessing technologies for use in the SITE (Site Innovative Technology Evaluation) program. What types of sites (waste type, volume, medium) is your mobile treatment unit best suited for?

Waste Type: See 4) above - liquid form

Volume: 10 gpm or multiples thereof. Any permanent installation can be installed up to 80 gpm.

D. On-Site Utilization

1. Mobilization requirements (time, transport) Set-up time: 3-4 days; Transportable on standard flat-bed trailer; set-up on concrete pad in open or in a minimal 1400 S.F. building.

2. Utility requirements 180 KW, 440 V, 3 phase, 60 hertz

Electrical enclosures: NEMA 1-A (gasketed).

3. If required utilities are not available at site, can you provide them?

Yes

4. Specify site preparation/space requirements Approximately 1400 S.F.

5. Time/labor requirement to bring unit on-line (including testing)

Two men from 3-4 days.

6. Number of personnel required for operation One

7. Time/labor requirement to dismantle unit Two men for 2 days

8. Equipment decontamination required No

9. What residuals/effluents are produced from your mobile unit?

Primary Waste Type	Residuals/ Effluents	Type of Further Treatment Required (if any)	Final Method of Disposal

All of list in 4) above. Liquid effluents contain short chain molecular organics that are biodegradeable in separate on-site biotreatment system for discharge to a stream or POTW; OR direct discharge to POTW without treatment. BOD's range depending on influent characteristics.

10. Does residual handling/treatment equipment comprise a significant component of on-site equipment and costs? If yes, outline system briefly

No - compared to over-all cost per gallon of treating the raw waste from generator.

11. Specify utility requirements for above Power, cooling water

12. Specify services not provided (e.g., excavation, transporting waste to mobile unit, treatment/disposal of residues)

None

E. Regulatory Requirements

1. Has your unit(s) ever been permitted by federal, state, or local governments? X Yes ____ No.

If so, describe type of permit(s) below. Federal and states of California, Michigan and Wisconsin.

2. Do you handle permitting of your unit? X Yes ____ No

3. Average time for approval 4 weeks to 8 months

4. Information required of client Site location, waste characteristics and volume, location of sewers, any other on-site waste treatment (owned by client), water courses and air discharge limitations.

5. Has regulatory approval been a significant time factor in the past? Please list issues that the client should be aware of

Michigan site - 4 weeks to satisfy effluent/air discharge requirements

California site - 8 months to satisfy air discharge requirements

Wisconsin site - 12 months for RCRA Part B permit

F. Costs

This section includes several questions on general costs and information requirements, and four site scenarios, each with several waste forms and types.

General Cost Guidelines

1. What type of site information and data on waste characteristics do you need to develop a general cost estimate? (e.g., BTU value) Require rate of liquid flow and COD of waste plus a 1-5 gallon sample for our waste characteristics. Also need effluent discharge requirements.

2. What additional information is needed for a detailed cost estimate? What key waste characteristics may significantly elevate treatment costs and difficulties?

Any unusual waste components that require alternate materials of construction. Standard unit is of titanium construction.

Site Scenarios (attached)

The following section contains four site scenarios and cost analysis sheet. Please read the site scenarios and determine if your mobile unit could be used on any of the waste forms on the sites. Then specify on the cost analysis sheet approximate treatment costs for use of your mobile unit. These costs need only be approximate and will be used as general guidelines. (If your mobile unit is applicable to more than one waste type and treatment costs differ significantly, you may want to complete more than one cost analysis sheet.)

Zimpro

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Leachate

COMPONENT: As Listed

Primary Costs (a)	Cost for Site	Cost/Unit Volume of Waste
1. Administration	______	______
2. Equipment	______	______
3. Permitting	______	______
4. Pre-Operational Testing	______	______
5. Operating Expenses (fuel, treatment additives)	______	______
6. Mobilization - Demobilization		
(Local - 100 miles)	______	______
(Non-local - 1000 miles)	______	______
7. Labor (on-site)	______	______
8. Laboratory Analyses	______	______

9. Volume of Residuals per unit volume of waste

____

Treatment requirements for residuals ______________________________

____

____

No application for wet air oxidation as the leachate is too dilute. Minimum COD concentration for a feasible application is 10 grams/liter.

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Pesticide

COMPONENT: As Listed

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration		
2.	Equipment		
3.	Permitting		
4.	Pre-Operational Testing		
5.	Operating Expenses (fuel, treatment additives)		
6.	Mobilization - Demobilization		
	(Local - 100 miles)		
	(Non-local - 1000 miles)		
7.	Labor (on-site)		
8.	Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals

No application for wet air oxidation as the contaminated groundwater and soil are too dilute. Minimum COD concentration for a feasible application is 10 grams/liter.

Zimpro

MOBILE TREATMENT UNIT COST ANALYSIS

SITE: PCB

COMPONENT: As Listed

Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1. Administration		
2. Equipment		
3. Permitting		
4. Pre-Operational Testing		
5. Operating Expenses (fuel, treatment additives)		
6. Mobilization - Demobilization		
(Local - 100 miles)		
(Non-local - 1000 miles)		
7. Labor (on-site)		
8. Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals

No application for wet air oxidation. The contents of the contiguous lagoon have sufficient COD concentration, but the PCB's are difficult to wet oxidize under the conditions of the mobile unit. The contaminated groundwater is too dilute.

Zimpro

MOBILE TREATMENT UNIT
COST ANALYSIS

SITE: Heavy Metals

COMPONENT: As Listed

	Primary Costs	Cost for Site	Cost/Unit Volume of Waste
1.	Administration		
2.	Equipment		
3.	Permitting		
4.	Pre-Operational Testing		
5.	Operating Expenses (fuel, treatment additives)		
6.	Mobilization - Demobilization		
	(Local - 100 miles)		
	(Non-local - 1000 miles)		
7.	Labor (on-site)		
8.	Laboratory Analyses		

9. Volume of Residuals per unit volume of waste

Treatment requirements for residuals

No application for wet air oxidation. The COD concentration is too dilute for a feasible application to either phase one or two.